"Like a sound of a page being turned in a book" - An exploration of the embodied strategies and subjective experiences that contribute to successful reading comprehension in both children and adults

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Thesis submitted for the degree of Doctor of Philosophy

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June 2017

Declaration

This thesis conforms to an 'article format' in which Chapters 2 to 5 include four discrete articles that are written in a style that is appropriate for publication in peer-reviewed journals in the field. Chapter 1 provides an overall introduction to the research areas included in the thesis and Chapter 6 provides a discussion of the findings.

I hereby declare that this thesis has not been and will not be, submitted in whole or in part to another University for the award of any other degree.

Signature:……

University of Sussex

Molly Berenhaus

A thesis submitted for the degree of Doctor of Philosophy

"Like a sound of a page being turned in a book[1]*"* - An exploration of the embodied strategies and subjective experiences that contribute to successful reading comprehension in both children and adults

Summary

The main aims of the current doctoral thesis included: (1) comparing the impact of different embodiment (manipulation versus enactment) and (2) perspective-taking strategies on children (9 to 10-year-olds) and adults' (18 to 30-year-olds) comprehension of narrative texts. In addition, we aimed to (3) better understand children's subjective experience (e.g., "What's going in your head while reading x?") while reading normally; e.g., at home or in the classroom.

Chapter 2 investigated the benefits of storyboard construction (SB), i.e., creating a visual representation of a narrative text using plastic cut-outs, on 5 children's comprehension monitoring and story recall. We found that children who constructed a storyboard while reading remembered more of the narrative texts versus business-as-usual controls and formed more coherent narratives during recall. Contrary to previous research (Rubman & Waters, 2000), SB had no positive impact on children's comprehension monitoring ability.

Chapter 3 included a subset (25 out of 35) of children from Chapter 2 and aimed to capture the nuances of children's experience while reading normally and how those experiences map onto comprehension performance. We found that children who

[1] Minchin, T. (2011) Quiet. [Recorded by Adrianna Bertola & Milly Shapiro]. *On Matilda, the musical* [Soundtrack]. Stratford-upon-Avon, England: Royal Shakespeare Company.

reported taking the perspective of a story's character (either spatially, emotionally and/or cognitively), while reading normally, performed better on measures from Chapter 1 (e.g., coherence of recall) than children who did not.

Chapter 3 presented a yearlong, longitudinal training study, which compared the immediate and long-term benefits of SB and Active Experiencing (AE), the act of becoming fully engrossed in communicating a text to another person, on children in Year 5's literal and inferential comprehension of emotion and spatial information in narrative texts. SB was found to improve children's story recall and performance on spatial-based questions immediately after training compared to other conditions (AE and controls). The benefits of SB training on recall continued three and six months later. In addition, AE training improved children's performance on emotion-based questions, but only immediately after training.

Finally, Chapter 4 first (Experiment 1) examined the effects of encouraging young adults to imagine themselves performing the actions of a protagonist or feeling what the protagonist is feeling (to empathise) while reading excerpts from *Dubliners* by James Joyce on their comprehension and emotional arousal. Empathising with the protagonist was found to increase readers' arousal, an indication of emotional reactivity. To follow up, we next measured the effects of encouraging young adults (Experiment 2) and children (Experiment 3) to empathise (feel what the character is feeling) or sympathise (care about how the character is feeling) with a story's protagonist while reading on a variety of inferential and literal comprehension questions. Young adults encouraged to sympathise with a story's protagonist had a particular advantage on comprehending literal emotion information about the protagonist as well as non-emotional, non-character-focused inferential and literal information. There was no effect of perspective-taking prompt on children's comprehension.

Acknowledgements

First of all, I would like to thank my supervisors, Jenny Rusted and Alan Garnham – I could not have done this PhD without your support and guidance. Jenny, thank you so much for your continued encouragement and for always believing in me. Alan, you swooped in when I needed emotional and academic support the most and I'm eternally grateful for your kindness, integrity and quiet office.

Second, I'd like to thank my trusty collaborators, Rebecca Graber (east coast!) and Robin Banerjee. Rebecca, thank you for being such an incredible friend (and colleague!) and for introducing me to the world of qualitative research. You made my PhD all the more interesting. Robin, you have been such an incredible mentor to me, since I started my tenure at Sussex, and I'm so glad to finally be working on a paper with you.

I'd also like to thank my original 3B16 officemates, Renata Fialho and Stephanie Wassenburg, for being such inspiring and amazing women. Steph, I learned so much from you during the first few months of my PhD. Thinking back on our chats kept me going, right when I was ready to give up. Renata, you are amazing in so many ways. Thank you for helping me stay on the ball and for being the office mom and resident clinical psychologist!

I'd also like to thank my wonderful support network at Sussex: Jennifer Mankin, Vlad Costin, Becks Atkinson, Louisa Rinaldi, James Alvarez-Ude, Claire Lancaster, Yasin Koc, Ellen Jo Thompson, Chris Brown and Aysha Karabulut.

I also want to give a BIG thank you to the amazing children who took part in my research. Your keenness to participate astounds me. I literally could not have completed this PhD without you!

Last but not least, I'd like to thank my amazing and supportive family: I could not have gotten through this PhD without the support from my mom, sister, dad, my incredible godparents, Steve and Sandy, and most adoringly, Joss.

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Declaration: Chapter 1

Chapter 1 includes an earlier version of a section (i.e., Discourse-Level skills) that was primarily written by the author of this thesis, from the book chapter:

Oakhill, J.V., Berenhaus, M.S., and Cain, K. (2015) *Children's reading comprehension and reading comprehension difficulites.* In: Pollatsek, Alexander and Treiman, Rebecca (eds.) Oxford Handbook of Reading. Oxford Library of Psychology. Oxford University Press.

Chapter 1: General Introduction

Discourse-Level skills

Successful comprehension of a narrative text requires the construction of a mental model, a multi-modal representation of the narrative situation from a particular point-of-view (Johnson-Laird, 1983). In order to form a coherent mental model, readers need to connect information from different parts of the text by making inferences. Readers also need to continually update their mental model and monitor their understanding of the text. These are both processes that depend on working memory capacity. The following sections: first Working Memory, second, Comprehension Monitoring and third, Inference and Integration, provide general background on the main components of reading comprehension. The section also introduces the difficulties experienced by poor comprehenders in all three skill-subsections. Given the studies that will be presented in the thesis, it is important to point out that the discussions of comprehension monitoring and inference making are most directly relevant to the experimental chapters. Specifically, the effects of strategies on readers' comprehension monitoring skills are explored in Chapters 2 and 3 and on readers' inference making skills in Chapters 4 and 5. Working memory is thought to make up the groundwork for successful reading comprehension:

Working memory. Many of the skills involved in forming a coherent mental model, such as inference making and comprehension monitoring, are dependent on the storage and coordination of information in memory. Many people who work on text comprehension adhere to Baddeley, Hitch and Bower's (1974) conception of working memory. Within this framework, these discourse-level processes are thought of as drawing on two components: the phonological loop (a short-term store of verbal information) and the central executive subsystem (which manipulates information from

short-term memory and long-term stores). In particular, the central executive process of working memory updating is considered essential for successful reading comprehension (Carretti, Cornoldi, De Beni & Romano, 2005).

Working memory updating refers to the modification of content stored in short-term memory to accommodate new input. For text comprehension, the updates to working memory must then be used to update the reader's mental model of a story, a representation stored in long-term memory. For example, if the reader inferred that the protagonist was a hard-working student (because she was always writing in her notebook during class), but later changed their interpretation because the text indicated that the protagonist never paid attention in class (because she was working on a detailed comic-strip instead of writing her history essay), the reader would need to update their mental model to accommodate this new information. A task to measure memory updating is a modification of a word-span task, in which participants are presented with a set of items and asked to recall the X smallest ones (Belacchi, Caretti & Cornoldi, 2010; Carretti et al. 2005). For example, if the participant were asked to pick the two smallest items out of the following sequence (listed one at a time): pencil, carrot, chair, pea, they would need to inhibit the item 'carrot' and update the list of items to be remembered on hearing 'pea' (Radvansky & Copeland, 2001). It is important to point out that updating a mental model during text comprehension may just involve adding new information, without modifying the existing mental model.

Although the main components of working memory are in place from an early age, substantial gains in capacity on both short-term storage and working memory tasks (those tapping the central executive) are evident across childhood (Gathercole, Pickering, Ambridge & Wearing, 2004). In relation to reading comprehension, working memory tasks that involve the manipulation and storage of verbal information correlate

more with reading comprehension ability in children and adults than tasks that involve the passive storage of information and manipulation of visuo-spatial information (Carretti, Borella, Cornoldi & De Beni, 2009). Independent measures of working memory are related to discourse-level skills: specifically comprehension monitoring, inference and integration, and knowledge and use of text structure (Cain, Oakhill & Lemmon, 2004). However, working memory ability in early childhood does not independently predict reading comprehension ability in later childhood when the influence of discourse skills (e.g., inference making, comprehension monitoring) is taken into consideration (Oakhill & Cain, 2012).

Children with poor reading comprehension are not impaired on measures of short-term storage, assessed by their ability to store and recall a set of words or digits (Cain, 2006; Cain, Oakhill & Bryant, 2000; Cain et al., 2004; Carreti et al., 2009; Oakhill, Yuill, Parkin, 1986; Stothard & Hulme, 1992). In contrast, poor comprehenders perform less well than their age-matched peers on tasks that require the storage and manipulation of verbal information (i.e., tasks that involve the central executive system). The dissociation in the relation between reading comprehension ability and performance on short-term storage versus storage and processing tasks (or complex span tasks) was supported by a recent meta-analysis conducted by Carretti, Borella, Cornoldi, and de Beni (2009). The study found that poor comprehenders performed worse than their age-matched peers on complex span tasks that involved verbal stimuli only (rather than visual-spatial stimuli). Thus, poor comprehenders' difficulty with working memory tasks may depend on the task's relevance to reading comprehension processes.

As noted earlier, some researchers have developed tasks to specifically measure the central-executive process of updating the contents of working memory (Radvansky

& Copeland, 2001). A clear finding from this research is that poor comprehenders are less likely to disregard no longer relevant information and therefore be unable to update their mental model (Cain, 2006; Carretti, et al., 2005; de Beni and Palladino, 2000). For example, Carretti et al (2005) found that 8- to 11-year-old poor comprehenders made more intrusion errors than good comprehenders. In terms of how this difficulty with updating might relate to reading comprehension difficulties, Carretti et al. (2005) suggested that poor comprehenders will have trouble forming a coherent representation of a text if they are unable to inhibit irrelevant information. In conclusion, certain working memory tasks can successfully differentiate between good and poor comprehenders; specifically, those tasks that involve verbal stimuli and involve complex operations.

Both of the physical simulation strategies explored in the current thesis (Active Experiencing and Storyboard Construction), which will be discussed later on in this chapter, are thought to enhance children's reading comprehension performance, in part, by freeing up working memory resources. Specifically, by acting out what is going on in a story with physical movements or plastic cut-outs, readers are thought to reduce their cognitive load by externalising the content of the narrative text (Glenberg, Gutierrez, Levin, Japuntich, & Kaschak, 2004; Rubman & Waters, 2000; Stevanoni & Salmon, 2005). By freeing up working memory resources, readers can more easily process incoming information, i.e., monitor whether they understand the text or not, relate the text to their stored background knowledge and update their mental model. Rather than measuring the effect of the strategies on working memory capacity, the current thesis chose to explore their effect on skills specific to reading comprehension: comprehension monitoring and inference making.

Comprehension monitoring. Comprehension monitoring is the ability to reflect on what has just been read: whether it made sense, whether it was enjoyable, what was learnt from the text, and what the main points were. In reading comprehension research, comprehension monitoring is often measured using an error-detection task. The error-detection task is thought to measure readers' ability to identify an inconsistency between two pieces of information in a text (Wassenburg, Beker, van den Broek, & van der Schoot, 2015). Whether the inconsistency has been detected can be measured explicitly by assessing detection errors, or implicitly by use of reading times and/or eye tracking.

Comprehension monitoring is likely to be closely related to reading comprehension because readers can only detect an inconsistency if they are actively engaged in the constructive process of reading. Thus, comprehension-monitoring skill is likely to overlap with other processes necessary for creating and maintaining a coherent representation of the text (i.e., constructing a coherent mental model, updating that model and activating information from that model). In general, younger children are less likely to realise that they do not understand, and less likely to know what to do about it if they do realise (for reviews, see Baker & Brown, 1984; Markman, 1981). Younger children find it difficult to detect that even crucial information is missing from a text. Markman (1977) found that young children (6 to 7-year-olds) failed to realise that there were serious inadequacies in instruction for how to play a game, or perform a magic trick, until they actually tried to carry out the instructions. Older children (8 to 9-year-olds) realised more readily that the instructions were lacking. In a further study, Markman explored children's ability to spot contradictions within a text. She found the youngest children (8 to 9-year-olds) had difficulty in spotting even blatant

inconsistencies, and even the oldest children (11 to 12-year-olds) missed a lot of the inconsistencies, although there was improvement with age (Markman, 1979).

Baker (1984) showed that children who were instructed in the criteria they should use when looking for problems in a text could identify more of the inconsistencies, but 9-year-olds still identified fewer problems than 11-year-olds. Baker suggested that, even when younger children are made aware of the sorts of problems they might encounter in texts, the competing demands on their cognitive resources might affect their ability to use the criteria effectively. Ruffman (1996) has suggested that younger children's information processing (e.g., an inability to derive more than a single interpretation of a text) contributes to their difficulty with monitoring their own comprehension, and Vosniadou, Pearson and Rogers (1988) showed that comprehension monitoring errors often arise simply because children fail to remember the inconsistent pieces of information. Information processing capabilities are known to increase with age (for a summary, see Oakhill, 1988), and it is likely that children's competence in comprehension monitoring will show a concomitant increase.

In summary, children develop the ability to reflect on their understanding during the primary-school years. Younger children's problems might be, at least in part, the result of their lack of knowledge of appropriate standards with which to evaluate their comprehension, and/or their difficulties in building a coherent representation of the text as a whole. The precise relation between comprehension monitoring and comprehension remains unclear. For instance, Markman (1981) suggests that the ability to reflect on comprehension is fundamental to comprehension itself. Others, however, have suggested that comprehension is fundamental to monitoring (Oakhill & Cain, 2012). Very few longitudinal studies have explored the relation between monitoring and comprehension over time to look at this pattern of relations. One exception was a study

by Chaney (1998) who showed that early monitoring skills predicted later reading ability (a combined measure of word reading and comprehension) four years later, and over and above the effects of general language ability. Oakhill and Cain (2012) found that comprehension monitoring at age 7 to 8 significantly predicted reading comprehension four years later, even when the autoregressive effect of comprehension had been taken into account. In addition, children's initial comprehension ability predicted their future comprehension monitoring performance. The findings suggest a reciprocal relationship between comprehension monitoring and general reading comprehensions.

The inconsistency detection paradigm (see above) has been used extensively to explore the nature and extent of comprehension monitoring differences between good and poor comprehenders. Oakhill, Hartt and Samols (2005) compared good and poor comprehenders' (9 to 10-year-olds) inconsistency detection abilities when the inconsistences were close in the text (in adjacent sentences) and more distant (separated by several sentences) and found that although poor comprehenders detected fewer inconsistencies in both conditions, the difference between groups was significant only in the distant condition. Similar results have been found for undergraduate good and poor comprehenders (Long and Chong, 2001). Those researchers then attempted to determine what process involved in constructing a coherent mental model failed for poor comprehenders. They argued that constructing a coherent mental model requires (1) activation of background knowledge and (2) updating of the mental model; if either or both skills are compromised, the ability to monitor comprehension will be compromised. The results from a subtle manipulation of the inconsistency detection task (i.e., they used a probe verification task, instead of comprehension questions, to measure the availability of character information) suggested that the poor

comprehenders were just as good at activating background knowledge as good comprehenders, but that they differed in their ability to integrate new information into their current text representation.

Storyboard construction, the strategy explored in Chapters 2 and 4, has already been found to improve children's (8 to 9-year-olds and 10 to 11-year-olds) comprehension monitoring; for purposes of this thesis, comprehension monitoring is defined as *both* the ability to firstly, detect an inconsistency and secondly, to correct it during recall (Rubman & Waters, 2000). In addition to replicating Rubman and Waters' (2000) findings, Chapter 2 also aimed to measure whether the strategy improved children's coherence of recall, a proxy measure of mental model coherence. The majority of the thesis (Chapters 4 and 5) focuses on the extent to which strategies improve the strength of readers' mental models, the cornerstone of successful comprehension. This was measured by their memory for narrative texts as well as their performance on literal and inferential comprehension questions.

Inference and integration. Inference making is essential for constructing a coherent mental representation of a text and thus, for successful reading comprehension. Inferences made whilst reading a narrative text can be divided into two categories: firstly, coherence inferences, which are necessary for understanding a text (i.e., establishing coherence) and secondly, elaborative inferences, which enhance the reader's mental representation of a text but are not essential for comprehension (Cain et al., 2001). Coherence inferences can be further subdivided into local and global coherence inferences. Local coherence inferences link two adjacent sentences together whilst global coherence inferences establish overall understanding of a text. Skilled adult readers make the required text connecting (local coherence) and possibly global coherence inferences quickly and effortlessly, but younger children and poor

comprehenders may have difficulties with inference making for various reasons. The chapters that explored the benefit of strategies on inference making (Chapters 4 and 5) focused on text-connecting inferences, because there is some doubt that skilled readers automatically make global-coherence inferences (McKoon & Ratcliff, 1992).

Although developmental studies have demonstrated that younger children are able to make the same inferences as older ones, they are unable to do so spontaneously, and may only do so when prompted or questioned (e.g., Casteel & Simpson, 1991; Omanson, Warren, & Trabasso, 1978; Paris & Lindauer, 1976; Paris & Upton, 1976). A number of studies have shown that the ability to make various kinds of inferences increases with age (e.g. Ackerman, 1986, 1988; Paris & Lindauer, 1976; Paris, Lindauer & Cox, 1977), although Ackerman (1988) and Ackerman and McGraw (1991) suggest that younger children may be making different, but not necessarily, fewer, inferences than older children. Ackerman (1986) suggested that age-related differences in spontaneous inference- making might be attributed to younger children not being able to see the need for coherence or elaborative inferences. Thus, because younger children are perhaps not aware that the aim of comprehension should be a coherent representation of the text as a whole, they do not appreciate the importance of coherence and elaborative inferences. Ackerman argued that younger children's inference failures cannot be attributed wholly to inferential ability, or to integration or processing limitations, but are probably also influenced by the way in which concept knowledge is organised and related to the child's mental model of the text.

A study by Barnes, Dennis and Haefele-Kalvaitis (1996) directly addressed the developmental relation between inference skills and background knowledge. The authors trained children – aged between 6 and 15 years – on a novel knowledge base, which they had to learn to criterion (perfect). They were then presented with a multi-

episode story, and asked questions, some of which required them to integrate their newly learned knowledge with information in the text to generate inferences. Even though the knowledge was available and could be accessed by all the children, regardless of age, this did not reduce the age-related differences in performance on inferential questions. Thus, as in comprehension monitoring, younger children may have trouble integrating background knowledge into their mental models.

Oakhill and Cain (2012) have shown that inference skill contributes to later comprehension skill between 7 and 11 years, over and above the contributions of vocabulary, verbal IQ, and the autoregressive effect of comprehension skill. This pattern suggests a possible causal link between inference skill and reading comprehension during development. Children's initial reading comprehension skill also predicted their inference skill later on. Like comprehension monitoring, the findings suggest a reciprocal relationship between inference skill and reading comprehension.

Studies that have investigated individual differences in reading comprehension ability have found that poor comprehenders generate fewer constructive inferences (a type of local coherence inference) relative to good comprehenders. For instance, inferences that require information from two different sentences in a text, e.g., “The boy was chasing the girl. The girl ran into the playground.” Infer: “The boy ran into the playground” (Oakhill, 1982). Memory for the text does not seem to be able to explain poor comprehenders’ difficulty because they are able to recall literal details from a text just as well as good comprehenders (Oakhill, 1982) and inference making difficulties are still apparent even when the text is available to refer to (Oakhill, 1984).

Additional support for the contention that poor comprehenders have difficulties with inference making comes from an investigation of good and poor comprehenders’ performance on different types of comprehension question (literal and inferential).

Bowyer-Crane and Snowling (2005) found that poor comprehenders had difficulties in making coherence inferences relative to their ability to answer questions about literal information. Good comprehenders did not differ on these two types of question. The poor comprehenders had particular difficulties with inferences that required elaboration of the text, or use of general knowledge. The relation between general knowledge and the inference problems of poor comprehenders has also been investigated using Barnes' paradigm, mentioned above, which keeps the knowledge base constant while investigating group differences in inference skill (Cain, Oakhill, Barnes & Bryant, 2001). The findings showed that, even when knowledge was controlled for in this very strict manner, less skilled comprehenders generated fewer inferences than did their skilled counterparts (Cain et al., 2001).

Elbro and Buch-Iversen (2013) hypothesised that comprehension problems may be caused by a reader not knowing how to correctly use background knowledge. The study focused on inferences that required integrating background knowledge with information from the text to help form a coherent mental model. They found that training that focused on the contribution of background knowledge for text comprehension improved 9 to 10-year-old children's ability to make inferences. Thus, inference making difficulties can be explained partially by an inability to use background knowledge appropriately. Additionally, in the study mentioned above Cain et al (2001) found that even when previous background knowledge is controlled for, poor comprehenders still have trouble making elaborative and coherence inferences, relative to good comprehenders. Thus, poor comprehenders' difficulty in making inferences may be explained by an inability to activate and select the relevant background knowledge to make the appropriate inferences.

Summary of discourse-level comprehension skills. This section has demonstrated that three different, but interrelated discourse-level comprehension skills: firstly, working-memory capacity, secondly, comprehension monitoring and thirdly, inference making and integration all, either directly or indirectly, contribute to the development of reading comprehension. These discourse-level skills are also able to explain differences between poor and good comprehenders. Interestingly, although working-memory capacity influences the extent to which children can update their mental representation, make inferences, and monitor their comprehension – all of which are essential for constructing a coherent mental model – working memory has not been found to contribute to reading comprehension ability directly. On the other hand, inference making and comprehension monitoring both independently predict reading comprehension ability.

Event-indexing model

One theory of mental-model construction that is particularly relevant to this thesis is the event-indexing model (Zwaan, Magliano, & Graesser, 1995; Zwaan & Radvansky, 1998). The event-indexing model proposes that events (e.g., an action performed by a character) are the building blocks of story comprehension and that each event is indexed along, at least, five dimensions: firstly, the **time** the event occurred, secondly, the **spatial** location of the event, thirdly, the **protagonist**(s) who were involved, fourthly, the **causal** status of the event in relation to previous events and finally, how the event relates to the protagonist's **goals** (Zwaan, Magliano, & Graesser, 1995; Zwaan & Radvansky, 1998). Therriault and Rinck (2007) proposed two protagonist sub-dimensions, which are both relevant to the current thesis: emotion and perspective. Emotion refers to the emotional state of the **protagonist** and perspective to the extent to which the reader (1) simulates the physical experience of the **protagonist**

and (2) adopts their mental state and viewpoint. Because the strategies explored in the current thesis encouraged readers to focus on two specific narrative dimensions, spatial and emotional information, readers' comprehension of those dimensions in narrative texts were measured in addition to their memory for the texts overall.

Strategies to improve reading comprehension

As demonstrated by the skill deficits of poor comprehenders, constructing a coherent mental model of a narrative text does not come naturally to all children. Not being able to comprehend what they read puts children at a disadvantage on a multitude of levels. First of all, reading is essential for learning (i.e., expository texts). In addition, reading narrative texts has been found to improve social skills, empathy and reduce prejudice (Mar & Oatley, 2008). More specifically, by reading narrative texts, readers simulate social situations they may not otherwise experience in real life and for a brief time, step into the shoes of a fictional character (Mar & Oatley, 2008). There are many types of strategies aimed at improving overall comprehension or specific discourse-level skills.

The current thesis chose to focus on strategies that encourage readers simulate the narrative situation and in turn, strengthen their mental models. The rationale is rooted in embodied theories of reading comprehension, which claim that constructing a mental model of a narrative situation involves (re)activating the motoric, sensory and affective neuronal systems necessary for experiencing situations in the world (Barsalou, 2008; de Koning, Bos, Wassenburg, & van der Schoot, 2016; Glenberg, 2011; Zwaan, 2015). Neuroimaging research supports this claim. The most compelling evidence comes from studies where participants were asked to read literary texts as they would normally, while undergoing fMRI (Hartung, Hagoort, & Willems, 2017; Kurby & Zacks, 2013; Nijhof & Willems, 2015). For example, Kurby and Zacks (2013) found

that when reading, participants activated sensorimotor areas consistent with experiencing what was being described in the text, i.e., when motor information was described (e.g, the actions performed by the protagonist), there was increased activation in the secondary somatosensory and premotor cortex; when auditory information was described (e.g, a whistle blowing), there was increased activation in the secondary auditory cortex. In addition, the activation only occurred when readers were required to read a coherent narrative passage compared to a collection of unrelated sentences. Thus, mental imagery of a narrative situation occurs predominantly when readers are engaged in constructing a coherent mental model of a larger discourse (Barsalou, Santos, Simmons, & Wilson, 2008).

Strategies that engage sensorimotor and affective processes, either through physical simulation (e.g., manipulating playset pieces) or mental imagery, have been found to improve skills related to reading comprehension in children and adults (de Koning et al., 2016; De Koning & van der Schoot, 2013a; Glenberg et al., 2004). In terms of physical simulation strategies, the current thesis focused on exploring the benefits of enactment and physical manipulation strategies.

Enactment strategies. Enactment strategies involve acting out the content of a text using the body (e.g., gesture). For example, Cutica (2014) found that encouraging 10-year-old children to act out a science concept they were reading about (e.g., the circulatory system) using gesture increased their memory for the text and as well as the number of discourse-based inferences they spontaneously generated at recall. Gesture has also been found to enhance children's ability to learn in other contexts (e.g, solve certain types of maths problems) (Cook, Mitchell, & Goldin-Meadow, 2008).

Active experiencing (AE), the act of becoming cognitively, emotionally and physiologically engrossed in communicating a text to another person (or audience

member) was the enactment strategy chosen to be explored in the current thesis, because, in addition to using gesture, the strategy encourages readers to engage with the emotional dimension of narrative texts (e.g., the emotional state of a character) (Noice & Noice, 2001). The term "active experiencing" was originally created to describe the process an actor uses to physically, emotionally and cognitively embody a character on stage. Noice and Noice (2001) explored the benefits of AE on memory by asking undergraduates with little or no acting experience to memorise their part in a scene with a partner in one of three conditions. For the first condition (full-AE), participants were coached on how to process the text using all lines of communication (emotional expression and physical movement). Thus, both participants were expected to fully embody their characters and act out the scene. For example, if the scene called for a confrontation, one of the characters would walk up to and get into the face of the other participant. For the second condition (partial-AE), the two participants would be sitting in chairs facing each other and instructed to get emotionally and cognitively involved in the narrative situation. They were able to use emotional expression and facial expressions but not allowed to move around. For the third condition, participants were simply instructed to memorise their part using any strategy necessary. The study found that participants in the full-AE condition remembered more of their lines than the other two conditions.

In the context of narrative text comprehension, children (7 to 11-year-olds) assigned to an AE condition were instructed to read a story out loud using emotional expression and movement (Berenhaus, Oakhill, & Rusted, 2015). Unlike the full-AE condition in Noice and Noice (2001), the participants were sitting down, but were encouraged to use hand gestures (unlike partial-AE). The study found that children in the AE condition had better memory for descriptive information in the narrative texts compared to

children who only read the narrative texts as they would normally. In summary, research has demonstrated the benefits of AE for improving both children and adults' memory for different types of texts. The potential benefits of AE on children's discourse-level comprehension skills (inference making and comprehension monitoring) have yet to be explored.

Physical manipulation strategies. Physical manipulation strategies involve using cut-outs or playset pieces to act out action sentences or narrative passages (Berenhaus et al., 2015; Glenberg et al., 2004; Marley, Szabo, Levin, & Glenberg, 2011; Rubman & Waters, 2000). Physical manipulation strategies encourage readers to focus on the visuo-spatial dimension of narrative texts (i.e., where characters and objects are located in a scene). A widely cited example of physical manipulation is Art Glenberg's Moved by Reading strategy (Glenberg, 2011; Glenberg, Brown, & Levin, 2007; Glenberg et al., 2004). For the Moved by Reading strategy, after reading an action sentence, children (6 to 8-year-olds) would be prompted to move playset pieces to act out what was described. For example, after reading the sentence, "the goat eats the hay," the participant would move the goat playset piece to the hay playset piece. Glenberg et al., (2004) found that the Moved by Reading strategy improved participants' memory for the narrative texts as well as their performance on spatial inference questions compared to participants who only looked at the playset while reading the text. The spatial inference questions tested participants' ability to combine information explicitly presented in the text with information from the playset. Glenberg et al., (2004) also found that participants benefitted in the same way from the physical manipulation strategy when they were asked to imagine manipulating the playset pieces.

In another example, Marley and Szabo (2010) found that 5 to 7-year-old children better recalled stories they listened to if they manipulated playset pieces while

listening, compared to children who flipped through a booklet with images of playset pieces in the correct locations. Participants in the manipulate condition also had improved recall when they were instructed to imagine manipulating the playset pieces. The benefits of the Moved by Reading strategy are thought to support the Indexical Hypothesis, which argues that language is understood in three steps: (1) by mapping words and phrases to objects in the environment, (2) by figuring out how the objects can be used (i.e., by deriving affordances) and finally (3) by meshing the affordances into a doable set of actions as directed by the sentence's syntax (Glenberg & Robertson, 1999).

Storyboard construction (SB) is another physical manipulation strategy very similar to Moved by Reading. The main difference is that instead of moving around playset pieces, readers manipulate 2-D plastic cut-outs to act out what is going on in the story (Rubman & Waters, 2000). SB was the physical manipulation strategy chosen to be explored in the current thesis because the strategy has been found to improve discourse-level comprehension skills. Specifically, Rubman & Waters (2000) found that children who constructed a storyboard while reading a narrative text were more likely to identify an inconsistency in a narrative compared to children who only read through the text.

Mental imagery. The current thesis also explored the benefits of mental imagery strategies on discourse-level comprehension skills. As demonstrated in Glenberg et al. (2004) and Marley and Szabo (2010), mental imagery can be used to help readers maintain the benefits of physical manipulation strategies. Mental imagery can also be trained as a strategy on its own. For example, de Koning et al. (2016) explored the benefits of a multi-modal mental-simulation training programme on readers' (8 to 9-year-olds and 9 to 10-year-olds) general reading comprehension and

reading motivation. The training programme included multiple instructional sessions where participants were encouraged to imagine themselves as the main character and simulate their multi-sensory experience (emotions, touch, smell, taste), to visualise the narrative situation and to simulate the movement of objects and characters. The study found that mental imagery training improved readers' general reading comprehension (8 to 9-year-olds but not 9 to 10-year-olds) compared to a business-as-usual control condition as well as their reading motivation (all participants). The authors theorised that mental imagery training only improved younger children's general reading comprehension ability because the training is most effective when reading skills are poor and children have not yet mastered alternative reading strategies.

Perspective-taking. A specific form of mental imagery that was also explored in the thesis is perspective-taking. A question that has not been resolved in the literature is whether it is more beneficial to adopt a character's perspective, an outsider's perspective or something in between whilst reading. Mar and Oatley (2008) argue that readers are best able to understand a characters' emotional state by monitoring their intentions and plans from an outsider's perspective, because that process mirrors how we understand the emotional state of others in real life. On the other hand, experimental paradigms have found that when readers are addressed as the protagonist in a story (e.g., read a text written with the "you" pronoun), they form a richer spatial mental model of the narrative situation (i.e., perform better on spatial inference questions) and are more emotionally involved compared to when reading texts written with the "I" or he/she pronoun (Brunyé, Ditman, Mahoney, & Taylor, 2011). Readers may be able to form a richer spatial mental model because experimental research suggests that they automatically adopt the perspective of the protagonist when constructing/updating the

spatial dimension of their mental models (Barnes, Raghubar, Faulkner, & Denton, 2014; Ziegler & Acquah, 2013).

The current thesis explored whether encouraging readers to adopt a specific perspective when reading could be used as a strategy to improve reading comprehension. In addition to comparing the effects of adopting a character's perspective along different dimensions (spatial versus emotional), we also compared encouraging readers to empathise or sympathise with a character. For the purposes of this thesis, to empathise with another person is to feel the emotions that the person is feeling and to sympathise is to feel concern and/or compassion for another person (Mar & Oatley, 2008).

Thesis Overview

The main aims of the current thesis were to explore the effects of embodiment (storyboard and active experiencing) and perspective-taking strategies on children (9 to 10-year-olds) and adults' (18 to 30-year-olds) comprehension of narrative texts. In addition, we aimed to better understand children's subjective experience while reading and to what extent their experiences mapped onto comprehension performance. In order to accomplish these aims, a combination of quantitative and qualitative methodologies was used.

Chapter 2 explored the effects of storyboard construction (SB) on 9 to 10-year-old children's comprehension monitoring, story recall and coherence of recall (a proxy measure of mental model coherence). Half of the children constructed a storyboard while reading a narrative text with an internal inconsistency and the other half read the text as they would normally. One week later, children in the SB condition were asked to imagine constructing a storyboard while reading a new narrative text to determine whether imagining constructing a storyboard would be as beneficial as constructing a

storyboard. In a supplementary analysis, the chapter also examined the relationship between children's subjective use of imagery while reading and comprehension performance.

In **Chapter 3,** a subset of children from Chapter 2 was interviewed on what was going on in their heads while reading self-chosen books. The interviews aimed to capture the nuances of their subjective experiences while reading. A thematic analysis was conducted (1) to better understand children's reasoning for constructing mental images and (2) to unpack the various forms of perspective-taking children reported using while reading. Based on the richness of children's interview responses, "perspective-taking", whether a child reported adopting a fictional character's point-of-view, was chosen as the grouping variable for the qualitative, follow-up analyses. More specifically, the analyses aimed to determine whether children who reported adopting a character's perspective while reading performed better on comprehension measures from Chapter 2.

Chapter 4 was a longitudinal training study that compared the immediate and long-term benefits of SB and Active Experiencing (AE) on 9 to 10-year-old children's memory for narrative texts as well as their literal and inferential comprehension of emotional and spatial information. The immediate benefits were measured by comparing the performance of children who were trained to use SB, AE or read as they would normally. The long-term benefits of training were measured three and six months after the original training session. During the follow-up sessions children in the SB and AE conditions were asked to imagine using their strategy while reading. In addition, in between the original testing session and the first follow-up session (three months later), children in the SB and AE conditions took part in monthly top-up sessions to be reminded of their strategy.

Chapter 5 explored the effects of perspective-taking prompts on both children (9 to 10-year-olds) and young adults' (18 to 30-year-olds) literal and inferential comprehension of narrative texts. Experiment 1 compared the effects of asking young adults (1) to imagine themselves performing the actions of the main character, seeing what the main character is seeing, (2) to imagine themselves as the main character, feeling what the main character is feeling (i.e., empathising with the main character), or (3) to read as they would normally, on their literal and inferential comprehension of emotional and spatial information in the texts. The effect of reading on feelings of arousal was also compared across groups. Experiment 2 further explored the effects of emotional perspective-taking on reading comprehension and arousal by comparing the effects of asking young adults (1) to imagine themselves as the main character, feeling what the main character is feeling (i.e., empathising with the main character) (2) to imagine themselves observing what is going on in the story, caring about how the main character is feeling (i.e., sympathising with the main character) or (3) to read as they would normally, on their literal and inferential comprehension of more specific information in the texts, i.e., emotional information about the protagonist, non-emotional information about the protagonist and non-emotional information not about the protagonist. Experiment 3 replicated Experiment 2 but with children (9 to 10-year-olds) as participants in order to determine whether the perspective-taking prompts could be used as a reading comprehension strategy in the classroom.

Declaration: Chapter 2

Prof. Jennifer Rusted (supervisor) and Prof. Jane Oakhill provided input on the study design, analyses and write-up.

Chapter 2: Bringing stories to life: The effects of storyboard construction on children's comprehension monitoring and story recall

Abstract

Encouraging children to create their own representation of a text has been found to improve skills related to reading comprehension. Using an updated version of Rubman and Water's (2000) storyboard construction task, the current study explored the effects of the task on comprehension monitoring and coherence of recall. Thirty participants between the ages of 9-10 were included. Half of the children constructed a storyboard while reading, whilst the other half only read the story. One week later, all participants read a different story and children in the Experimental condition were asked to imagine constructing a storyboard. During the first session, children in the storyboard condition recalled the text more coherently and remembered more idea units, but there was no effect of condition on comprehension monitoring. There was no difference between conditions during the second session. Interestingly, children's subjective use of imagery correlated with general listening comprehension ability and comprehension monitoring performance during Session 2 only. The importance of these findings in terms of developing helpful reading comprehension practices will be discussed.

Introduction

The process of constructing a successful mental model is how readers are able to understand narrative texts (Cutica, Ianì, & Bucciarelli, 2014; Johnson-Laird, 1980; Therriault & Rinck, 2007; Zwaan & Radvansky, 1998). A mental model is a representation of the real, or an imaginary, world "from a particular point of view" (Johnson-Laird, 1983, p. 165). Coherence is established within a mental model by linking events from a narrative text in a way that preserves the causal structure of the original story (Diehl, Bennetto, & Young, 2006). Developmental research has suggested that at least some of the skills necessary for constructing a coherent mental model (i.e., discourse-level comprehension skills) are causally implicated in children's reading comprehension ability (Oakhill, 1996; Oakhill & Cain, 2012).

One of the discourse-level comprehension skills essential for constructing a coherent mental model is comprehension monitoring (Markman, 1979; Oakhill et al., 2005; van der Schoot, Reijntjes, & van Lieshout, 2012). Comprehension monitoring is an executive process that directs a reader's attention toward information (e.g., either background knowledge or in the text) that that will help them understand a story more efficiently (Kolić-vehovec, 2006). Comprehension monitoring can be situated within the Construction-Integration (CI) model of comprehension, which argues that comprehension of any text starts with the mental "activation" of information presented in the text as well as relevant background knowledge (Kintsch, 1998; Mcnamara & Magliano, 2009). Within the CI model, comprehension monitoring can be explained as a skill to help readers activate the knowledge that will be integrated into their situation model (for this thesis, synonymous with mental model) of the narrative text. This skill is most commonly assessed using an inconsistency detection task (Markman, 1979). During this task, the reader is asked to determine whether a set of sentences make sense.

If the reader explicitly states a set of inconsistent clauses does not make sense and explains why, they have successfully detected an inconsistency, one element of comprehension monitoring. Oakhill et al. (2005) found that poor comprehenders, children who are adequate word decoders but below-average comprehenders, are particularly bad at identifying internal inconsistencies, a clause contradicting something mentioned earlier in the text, because they require the reader to maintain an active mental model of the text. Poor comprehenders' deficiencies are specific to the reading process, such as inference making (irrespective of background knowledge and memory capacity) and updating, thus making mental model construction difficult (Cain, Oakhill, Barnes & Bryant, 2001; Long & Chong, 2001; Oakhill, Berenhaus & Cain, 2015; Oakhill, 1984; Oakhill, 1982).

A problem with the inconsistency detection paradigm is that it requires the reader to acknowledge that a text does not make sense, which is an unanticipated outcome for most readers. Thus, inconsistency detection measures readers' awareness of their own understanding, and this task alone may not fully capture comprehension monitoring abilities in children (Baker, 1979; Kolić-vehovec, 2006). For example, because children's awareness of strategies they use to comprehend a text (e.g., rereading part of a story they find difficult) does not correlate with comprehension ability until late childhood (i.e., 12/13 years old), it is difficult to map inconsistency detection onto the strategies used in executing it (Kolić-vehovec, 2006). Thus, more covert measures of comprehension monitoring strategies, such as inconsistency correction during recall, may be more useful for measuring comprehension monitoring .

Encouraging children to construct their own mental model of a text, through, for example, mental imagery (Gambrell & Bales, 1986; Oakhill & Patel, 1991) or manipulation and imagined manipulation strategies (i.e., moving around props to act out

a text) (De Koning & van der Schoot, 2013a; Glenberg et al., 2004; Lesgold, De Good, & Levin, 1977; Rubman & Waters, 2000), has been found to improve children's inconsistency detection performance and other skills related to reading comprehension. Manipulation strategies in particular ground children's experience with a text because they encourage children to map actions in a text to the external world (Glenberg, 2011; Glenberg et al., 2004; Marley & Szabo, 2010). In terms of previous evidence of the benefits of manipulation and imagined manipulation strategies on children's memory for narrative texts, Glenberg and colleagues' (2004) seminal study found that asking children (7 to 8 years old) to act out action sentences they read (e.g., "Ben gets eggs from the chicken") using a playset, improved their cued and free recall for those sentences compared to children instructed to only *look* at the playset after reading. Children in the first condition still had improved cued and free recall after being asked to *imagine* acting out the action sentences for a new text, using the playset, with the playset *still visible*, compared to children only instructed to look at the playset after reading. Marley and Szabo (2010) aimed to extend Glenberg and colleague's (2004) findings by comparing the effects of asking children to manipulate playset pieces, after listening to action sentences, to the effects of asking children to look at images of the playset pieces in their correct positions on children's (5 to 7-year-olds) free and cued recall of action sentences (Instructional Period 1). The study also compared the effects of asking children in both conditions to:

- (Instructional Period 2) After hearing an action sentence, first, closing their eyes and picturing the event in their heads. Next, opening their eyes and either acting out the action sentences or flipping to the appropriate page in the picture book (depending on their condition)

- (Instructional Period 3) After hearing an action sentence, closing their eyes and picturing the event in their heads, only (*without* access to the storyboard).

For all three instructional periods, children in the manipulation condition had improved free and cued recall for the action sentences. The point of the study was to demonstrate that both physical and imagined manipulation would benefit children's memory for a story over and above just looking at completed vignettes for each action, even *without* access to the playset. Marley and Szabo's (2010) study succeeded in further distilling the benefits of the manipulation-element of the strategy.

Rubman and Waters (2000) explored the benefits of a manipulation strategy for improving children's comprehension monitoring for skilled versus less-skilled readers (determined by word-decoding ability). They instructed half the participants (8 to 9-year-olds and 11 to 12-year-olds) to construct a visual representation of a descriptive text using plastic cut-outs ("storyboard construction") (Rubman & Waters, 2000). The rest of the children simply read through the story. Half of the children in each condition read a descriptive text with an internal inconsistency and the rest read one with an external inconsistency (i.e., one clause was inconsistent with background knowledge). Irrespective of age, reading ability and inconsistency-type, children in the storyboard condition were more likely to monitor their comprehension (either detect the inconsistency or correct it during recall, which Rubman and Waters (2000) referred to simply as "inconsistency detection") than children who only read through the story twice. Not surprisingly, skilled readers were more likely to monitor their comprehension overall. Although storyboard construction could be viewed as more in line with the Marley & Szabo control condition, like the 3D playsets used in the two aforementioned studies (Glenberg et al., 2004; Marley & Szabo, 2010), storyboard construction requires

participants to physically add/move around plastic cut-outs on a background. The main difference is that instead of asking children to move objects within a 3-D space, they are moving objects within a 2-D space. Although, the latter is potentially less ecologically valid, storyboards are easier to create for different narrative situations, transport and potentially, to one day digitise.

Using the storyboard construction task, the current study aimed to unpack the effects of storyboard construction on inconsistency detection versus inconsistency correction during recall in order to explore the strategy's effect on explicit versus implicit components of comprehension monitoring. Since comprehension monitoring and reading comprehension are so closely linked, the current study also explored the effects of storyboard construction on children's coherence of recall, a proxy measure of mental-model coherence, in addition to recall (Cutica et al., 2014). Storyboard construction was chosen because it is one of the few approaches to reading comprehension rooted in embodied cognition theory (see De Koning & van der Schoot, 2013 and Glenberg et al., 2004 for other examples). In this context, the aim of storyboard construction is to scaffold the creation of children's mental models of stories. Specifically, the visuospatial dimension of their, what is thought to be multidimensional, mental models, according to the event-indexing model (Barnes et al., 2014; Zwaan & Radvansky, 1998). Depending on a child's baseline ability to construct the visuospatial dimension their mental model, storyboard construction may be more or less beneficial. Specifically, a child who has difficulty constructing the spatial dimension of their mental model might benefit more from storyboard construction than a child who has mastered the process. By aiding the construction of the visuospatial dimension, SB may, as a result, boost children's overall understanding of a narrative text.

Another aim of the current study was to determine whether storyboard construction could be used as an imagined manipulation, rather than requiring a physical storyboard, in order to be more easily applied to everyday reading situations (Glenberg et al., 2004; Marley & Szabo, 2010). To accomplish this aim, during a follow-up session one week after the original session we asked children in the storyboard construction condition to *imagine* constructing a storyboard while reading a novel story and again, assessed comprehension monitoring, recall and coherence of recall. Because imagery training has been found to be more beneficial for poor comprehenders (Oakhill & Patel, 1991), a secondary aim of the current study was to investigate the relations between use of imagery and children's reading comprehension abilities. Very few studies have explored the relation between use of imagery and reading comprehension ability (for exceptions see Sadoski, 1983, 1985).

Unlike Rubman and Waters (2000), children were not divided into groups of skilled and less skilled readers; in this way, the effectiveness of the procedures could be tested across the full range of abilities (Barnes, Stuebing, Fletcher, Barth, & Francis, 2016). The current study included only one age group (9 to 10-year-olds) and one inconsistency type (internal inconsistencies). We used internal inconsistencies because they can be detected within the text, without recourse to background knowledge. Based on previous research, it was predicted that more children in the storyboard condition would explicitly detect the inconsistency and correct the story's inconsistency during recall compared to children who only reread the story (Rubman & Waters, 2000). Additionally, it was predicted that children in the storyboard condition would recall more idea units and have more coherent recollections during recall. The follow-up session was introduced to see if imagining constructing a storyboard could also be a useful strategy; no specific predictions were made, although it is important to remind

the reader that more elaborate intervention studies have found that with extensive training, encouraging children to imagine using a manipulation strategy can help them maintain the benefits of the original manipulation strategy (Glenberg et al., 2004; Marley & Szabo, 2010). Additionally, analyses were included to measure how subjective use of imagery is related to component comprehension skills. In, the current study, it was predicted that children's subjective use of imagery would correlate positively with skills related to reading comprehension, such as listening comprehension, word reading and children's memory for the stories.

Methods

Participants

Thirty-five children (10 males and 25 females) from Year 5 between the ages of 9 and 10 (M = 120.50 months, SD = 3.25) participated in the current study (SB = 18, *Reread* = 17). One child in the reread condition was absent for the follow-up session. The two groups were matched for listening comprehension (NARA-II) and word reading (GM). The sample was unselected but excluded children whose first language was not English or who were diagnosed with a specific learning disability (e.g., dyslexia). In addition, children who performed 1.5 SDs or more below the year-group mean on the Gates-MacGinite Vocabulary Test (Level 3), an indication of word reading ability, (GM < 20 out of 45) were excluded in order to make sure participants could perform the reading task. Participant characteristics for children in both conditions are included in Table 1. Before working with each child, we obtained written consent from their parent or guardian in accordance with the ethics procedure set out by the University's research Ethics Committee. Additionally, each child was informed that they could stop and leave at any point during the study.

Table 1

Participant Characteristics

	Storyboard group		Reread group			
	N = 18		*N* =17			
Measure	*M*	*SD*	*M*	*SD*	*t*(33)	*p*
Age (Months)	120.46	3.53	120.54	3.03	0.08	.939
NARA-II	12.39	6.45	12.44	5.81	0.23	.980
G-M	33.78	6.76	36.00	6.49	0.99	.329
Imagery	3.50	1.25	3.71	0.93	0.55	.584

Materials

The Neale Analysis of Reading Ability- R (NARA-II) (Form 2), administered as a listening comprehension test, was used for the group comprehension assessment (Neale, 1997). There was one practice story, read out loud as an example, and six test stories in total. Children were given an answer booklet with 8 comprehension questions per story (including the practice story) where children had to write their answers individually. The Gates-MacGinite Vocabulary Test, Level 3 (G-M) was used to measure children's word-reading ability (MacGinite et al., 2000). It is a multiple choice, pen and paper task; there are four examples children worked through with the experimenter and 45 test questions that children worked through on their own. For each question, children had to decide which word (out of a choice of four; e.g., "clean", "at the store", "first" and "near") matched a word or short description (e.g., "they are close"). To assess children's subjective use of imagery when reading normally, they were asked "when you are reading books, even when they don't have pictures in them,

do you see pictures in your mind of what you're reading?" Children chose one of five responses on a Likert scale: never, rarely, sometimes, a lot or always.

For the main Experiment, the stories were taken from Rubman and Waters (2000). Both stories contained one internal inconsistency. Two raters independently divided the stories into idea units and discussed any discrepancies, Kappa = .91, $p < .001$. *Different Fish* was divided into 24 idea units and *Al's Room* was divided into 29 idea units. Although *Different Fish* was used in Rubman and Waters (2000), it was originally taken from Markman (1979); Al's *Room* was written specifically for Rubman and Waters (2000). The idea unit divisions for both stories can be found in Appendix I. Two storyboards were created, one for each story, which were based on those used by Rubman and Waters (2000). A storyboard consisted of a colourful, laminated background scene (10 x 12 inches) that corresponded to the setting of the story. A storyboard also had six laminated cut-outs (between 2-3 inches tall) that corresponded to characters or objects found in the text (both storyboard backgrounds with their corresponding cut-outs can be found in Appendix II). A digital voice recorder was used to record children's responses and to later code inconsistency detection and recall.

Design

There were two test sessions and in each test session there was one between-subjects, independent test variable: condition (two levels: storyboard construction and control). There were also five dependent variables: inconsistency detection, inconsistency correction, proportion of idea units recalled, coherence of recall and use of imagery. Inconsistency detection and inconsistency correction were determined using a binary measurement[2]. NARA-II and G-M scores were covariates.

[2] In previous research, inconsistency detection has either been measured using a binary measurement (i.e., did the child notice the inconsistency or not?) or a point system (Markman, 1979; Oakhill et al., 2005; Rubman & Waters, 2000). For the point system,

Procedure

Group Test Session. For the group session, participants were tested in their classroom. Teachers administered the listening comprehension assessment and the G-M to the entire classroom (around 25 children per classroom).

Experimental Session. After the test session, children that met the inclusion criteria were introduced to the procedure and tested individually. Participants were tested in a quiet room at their primary school near their classroom. During this individual test session, participants were first asked to fill out the imagery questionnaire. Then the participants were asked to read either *Different Fish* or *Al's Room* twice through. The children were first asked to read the story to themselves to get a general sense of the text. Then, they were instructed to read the story again to make sure everything made sense. For the second reading, children were instructed to look up when they had finished reading so that the experimenter could measure reading times (this procedure differs slightly from that used by Rubman and Waters' (2000) because in that study, children were asked to make sure the story made sense before the first reading rather than the second reading). Before the second reading, children in the storyboard construction condition were given a storyboard with its cut-outs scattered to the side of the board. They were instructed to construct a storyboard using the cut-outs that corresponded to actions in the text. Children in the control condition were not presented with the storyboard. Instead, they were asked to read the story slowly to make sure everything made sense. This was an attempt to match reading times of the two conditions. Reading time was recorded. After the second reading, the experimenter took

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children are given the highest number of points if they detect the inconsistency after a general prompt (e.g., "was there something wrong with the story?"), fewer points for detecting the inconsistency after specific prompts that highlight the inconsistency (e.g., "How can Al's room be clean if his toys are everywhere"), and no points for failing to detect the inconsistency. Although the point system gives children more opportunity to detect the inconsistency, the binary measurement is more stringent.

a digital photo of participants' storyboards to allow later assessment of whether they were constructed accurately.

Inconsistency Detection and Recall. The experimenter first asked participants two general probe questions to see whether they noticed the inconsistency in the text ("Did everything the story make sense?" and "Was there anything wrong with the story"). Children's responses were recorded. Then, participants were asked to recall everything they remembered from the story. Finally, participants were asked story-specific probe questions to give them a few more opportunities to notice the text inconsistency (Rubman & Waters, 2000). Children's performance on the story-specific probe questions were not included in the main analysis (i.e., to determine whether children noticed the inconsistency), but were rather included in a supplementary analysis. After the interview, children were given a small toy in appreciation of their participation (e.g., crayons, a spinning top).

Follow-up Test Session. One week later, the experimenter met individually with every child who participated in the initial test session. The experimenter first administered the imagery questionnaire again to assess participants' reliability in responses. Then, the experimenter asked every participant to read a second story (if the child read *Different Fish* during the first session, they were asked to read *Al's Room* during the follow up and vice- versa). The procedure was almost identical to the first test session/Inconsistency Detection and Recall interview, except that the children in the storyboard condition were asked to imagine using the storyboard in their mind's eye rather than being required to construct an actual storyboard.

Scoring

Neale Analysis of Reading Ability II. The experimenter marked the listening comprehension assessment by comparing children's written answers to a list of

acceptable answers (Neale, 1997). Children could earn up to one point per question (.5 points were also awarded for relevant partial answers). Raw scores were used in the analyses because the scoring procedure differed from the standard NARA-II scoring procedure.

Gates-MacGinite. For the word reading assessment, children were assigned one point for every question they answered correctly. There were 45 items in total.

Imagery Question. Children's responses were converted to a score out of five. For example, children received one point if they answered "never" and five points if they answered "always." Across both sessions, participants responded consistently, Kappa = .79, $p < .001$; correlation between 1st and 2nd session: r = .940, $p < .001$. For all analyses, children's mean imagery score across both sessions were used.

Inconsistency Detection. Inconsistency detection was measured using a binary measurement (i.e. detected/not detected). Children were given a score of one if they successfully identified what was wrong with the test story when answering the general probe questions or spontaneously during recall. Children were given a score of zero if they failed to notice the inconsistency. To make sure the scoring was reliable, two raters independently scored children's inconsistency detection for both test sessions, Kappa = 1.00, $p < .001$.

Inconsistency Correction. Inconsistency correction was also measured using a binary measurement. Children were given a score of one if they corrected the inconsistency during recall and a score of zero if they either stated the inconsistency or left it out during recall. Because children's inconsistency-correction ability was used as a measure of implicit comprehension monitoring, children's recalls were not scored for inconsistency correction if they had already detected the inconsistency. Two raters

independently scored children's inconsistency correction for both test sessions, Kappa (first test session) = .87, $p < .001$; Kappa (follow-up test session) = .90, $p < .001$.

Recall. The audio recordings were transcribed and the transcripts were scored by one rater, but to make sure the coding was reliable, a second rater scored 10% of the transcripts for both test sessions, Kappa (first session) = .94, $p < .001$; Kappa (follow-up session) = .96, $p < .001$. A protocol for scoring recall can be found in Appendix III. It was decided before scoring that correct idea units did not need to be recalled in the same order as in the story but had to be in reference to the same section of the story. Number of idea units recalled was converted to proportions rather than raw scores, because the two test stories had different numbers of idea units (29 compared with 24).

Coherence of Recall. Two raters independently scored each transcript for coherence (from 1-5 for each session), Kappa (first session) = .92, $p < .001$; Kappa (follow-up session) = .96, $p < .001$. A protocol for scoring coherence of recall can be found in Appendix IV. A score of one was given to recall transcripts that had no correct information from the story and a score of 5 if the transcript maintained the causal structure of the story and included connectives (examples of very coherent (5 points) and non-coherent (1 point) story recalls can be found in Appendix V). It is important to note that the coherence of recall measure was subjective (5-point scale), but double coded, and not based on the exact number of connectives within each recollection.

Storyboard Accuracy. Children's storyboards were scored for accuracy. One point was awarded for every cut-out that matched-up with what happened in the story (Rubman & Waters, 2000). For example, for the phrase, "The toy cat and mouse […] were now lying at the foot of the bed" in *Al's Room,* a child would be awarded two points if he/she placed both the cat and mouse cut-outs at the foot of the bed (either at the bottom of the bed or on the floor). A child would only be awarded one point if they

placed either the cat or mouse cut-out at the foot of the bed and zero points if they, for example, placed the cat and mouse cut-outs on the windowsill.

Fourteen out of eighteen (77.8%) participants' storyboards were completely accurate (i.e., all 6 cut-outs were in the correct position when children finished reading the story). Two out of eighteen (11.1%) of participants placed one cut-out incorrectly onto the storyboard (e.g., for *Al's Room*, a participant placed the green rubber ball on the chair instead of underneath the chair).

Reading Time. As an additional measure, the length of time it took each child to read the test story (seconds) was measured from an audio recording.

Results

The results will be presented in two sections. The first section lays out the effects of storyboard construction on comprehension monitoring and children's memory for the story (measured by story recall and coherence of recall). The first section also addresses the relation between children's subjective use of imagery (averaged across both sessions) and skills related to reading comprehension (baseline measures and those collected during the first test session). The second section mirrors the first but reports the effects of encouraging children to *imagine* constructing a storyboard. The second section also reports the relation between subjective use of imagery and skills related to reading comprehension (only those data collected during the second test session).

Session 1

The effects of storyboard construction on comprehension monitoring

Based on the findings from Rubman and Waters (2000), it was predicted that more children in the SB condition, compared to children in the reread condition, would either notice the inconsistency or correct it during recall. Frequency analyses were conducted to examine the effects of storyboard construction on inconsistency detection

and correction during recall, separately[3]. The number of children who successfully detected or corrected the inconsistency per condition is presented in Table 2. Across both conditions, only 4 out of 35 participants (11.43%) successfully detected the story's inconsistency. In contrast to predictions, a Fisher's exact test[4] indicated there was no significant association between condition and inconsistency detection, p (one-tailed) = .*677, ns.* For inconsistency correction, 12 out of 31(38.71%) of participants (not including those who detected the inconsistency) successfully corrected the inconsistency during recall. Again, contrary to predictions, there was no significant association between condition and inconsistency correction, $\chi^2(1) = .020$, p (one-tailed) = .886, *ns.* Thus, in contrast to the predicted findings, encouraging readers to construct a storyboard while reading did not improve the likelihood that children would detect the text's inconsistency or correct it during recall, compared to asking children to reread the narrative.

Table 2

Contingency table showing how many children detected the inconsistency or corrected it during recall as a function of condition

		Condition		
		Storyboard	Reread	Total
Detection?	Yes	2	2	4
	No	16	15	31
	Total	18	17	35
Correction?	Yes	6	6	12

[3] As a supplementary analysis, comprehension monitoring was also measured using Rubman and Waters' (2000) points-based system: children were awarded 4 points if they detected the inconsistency outright, 3 points if they detected/corrected the inconsistency during recall, 2 points if they detected/corrected the inconsistency during story-specific probe questions and 1 point if they failed to notice the inconsistency. A one-way between measures ANOVA, measuring the effect of condition on comprehension monitoring, did not find a significant effect of condition on comprehension monitoring during Sessions 1, $F(1,32) = 0.03$, $p = .874$, $\eta_p^2 = .001$, and 2, $F(1,32) = 0.02$, $p = .884$, $\eta_p^2 = .001$.

[4] Fisher's exact test was used whenever one or more expected frequencies was less than 5 (Field, 2009).

No	10	9	19
Total	16	15	31

The effects of storyboard construction on children's memory for a story

Based on the findings from similar intervention studies, it was predicted that children in the SB condition would remember more idea units and have more coherent recollections than children in the reread condition (Berenhaus et al., 2015; Glenberg et al., 2004; Rubman & Waters, 2000). A one-way ANCOVA with listening comprehension (NARA-II) and G-M as covariates revealed a significant effect of condition on recall, $F(1,31) = 7.67$, $p = .009$, $\eta_p^2 = .198$. More specifically, as predicted, children in the storyboard condition recalled a significantly higher proportion of idea units ($M = .428$, $SD = .157$) than children in the reread condition ($M = .313$, $SD = .159$). Additionally, children's G-M scores significantly contributed to the effect, $F(1,31) = 4.52$, $p = .02$, $\eta_p^2 = .127$. To explore the effect of condition on coherence of recall, a one-way between measures ANCOVA was conducted with listening comprehension and G-M as covariates. There was a significant effect of condition on coherence of recall, $F(1, 31) = 7.02$, $p = .012$, $\eta_p^2 = .186$. More specifically, as predicted, children in the storyboard condition had higher coherence scores ($M = 3.28$, $SD = 1.07$) than children in the reread condition ($M = 2.41$, $SD = 1.94$). There was no significant impact of either covariate, $p > .430$. The results suggest that creating a storyboard of the narrative situation while reading improves children's memory for a story and their coherence of recall, compared to children in the reread condition.

However, it is important to point out that children using storyboards took longer to read the narrative texts, compared to children in the reread condition. Thus, a further analysis was conducted to examine whether reading time (in seconds) predicted the proportion of idea units recalled and/or coherence of recall over and above condition.

The analysis revealed that although participants who constructed a storyboard while reading took longer to read the test story (M = 78.00 s, SD = 21.44 s) than participants in the reread condition (M = 50.35 s, SD = 13.71 s), $t(33) = 4.52$, $p < .001$, reading time did not significantly correlate with proportion of idea units recalled, $r = .24$, $p = .157$, or coherence of recall, $r = .30$, $p = .080$. Thus, reading time was considered a less likely alternative explanation for the effect of condition on recall.

The relation between use of imagery and skills related to reading comprehension

It was predicted that how often children report using metal imagery would positively correlate with performance related to reading comprehension, because of their assumed relationship (Sadoski, 1983 & 1985), to investigate the relationship between children's subjective use of imagery and skills related to reading comprehension, nonparametric correlations, because the imagery scale was not normally distributed, were computed between subjective use of imagery (averaged across Sessions 1 and 2), NARA-II, GM, proportion of idea units recalled, coherence of recall and Rubman and Water's (2000) 4-point scale measuring comprehension monitoring (Bonferonni correction for 5 analyses, $p < .01$). The analyses found that subjective use of imagery only correlated significantly with NARA-II scores, $r_s = .534$, $p < .001$, only.

Session 2

The effects of imagined storyboard construction on children's comprehension monitoring

One week after the first test session, participants were asked to read the other inconsistent story. This time, participants who had been in the storyboard condition

were instructed to imagine constructing a storyboard in their mind's eye. No specific predictions were made, but more intensive intervention studies have found that training children to imagine using a manipulation strategy they previously had experience using, helped children maintain the benefits of the original manipulation strategy on recall (Glenberg et al., 2004; Marley & Szabo, 2010). It is important to remind the reader that during Session 1, contrary to predictions, creating a storyboard while reading did not improve children's comprehension monitoring ability compared to children in the reread condition. For Session 2, frequency analyses were conducted to examine the effects of imagined storyboard construction on inconsistency detection and correction during recall. The number of children who successfully detected or corrected the inconsistency per condition is presented in Table 3. Across both conditions, 10 out 34 participants (29.41%) successfully detected the inconsistency. A Fisher's exact test indicated there was no association between condition and inconsistency detection, p (one-tailed) = .440, *ns*. Of the children who did not detect the inconsistency, a further 8 out of 24 participants (33.33%) corrected the inconsistency during recall. A Fisher's exact test indicated there was no significant association between condition and inconsistency correction, 1.00, *ns.*

Table 3

Contingency table showing how many children detected the inconsistency or corrected it during recall as a function of condition.

		Condition		
		Storyboard	Reread	Total
Detection?	Yes	6	4	10
	No	12	12	24
	Total	18	16	34
Correction?	Yes	4	4	8
	No	8	8	16
	Total	12	12	24

The effects of imagined storyboard construction on children's memory for a story

It is important to remind the reader that during Session 1, as predicted, creating a storyboard while reading improved children's recall and coherence of recall compared to children in the reread condition. For Session 2, to explore the effect of condition on the total proportion of idea units recalled, a one-way between measures ANCOVA was conducted with listening comprehension and G-M as covariates. There was no significant effect of condition on the total proportion of idea units recalled, $F(1,30) = 1.99$, $p = .169$, *ns*, $\eta_p^2 = .062$; neither was there significant effect of condition on coherence of recall, $F(1,30) = 2.18$, $p = .151$, *ns*, $\eta_p^2 = .068$. Thus, in contrast to previous research, encouraging children in the SB condition to imagine constructing a storyboard for a different story than Session 1, did not help children maintain their advantage on recall and coherence of recall compared to children in the reread condition. In addition, NARA-II significantly contributed to the effect of condition on coherence of recall, $F(1,30) = 7.25$, $p = .011$, $\eta_p^2 = .198$. See Table 4 for a summary of means and SDs for both analyses.

Table 4

The total proportion of idea units recalled and coherence of recall as a function of condition.

	Storyboard condition		Reread condition		Total	
	M	*SD*	*M*	*SD*	*M*	*SD*
Proportion Recalled	.363	.171	.319	.121	.342	.149
Coherence of Recall	2.78	1.17	2.44	.73	2.62	.99

The relation between use of imagery and reading comprehension performance

To remind the reader, it was predicted that children's subjective use of imagery would correlate with measures of reading comprehension. In support of this prediction, correlations indicated that subjective use of imagery correlated with Rubman and

Water's 4-point comprehension monitoring scale, r_s = .522, p = .001. In contrast to predictions, similar to Session 1, neither proportion of idea units recalled nor coherence of recall (Session 2) was significantly associated with children's subjective use of imagery**.**

Discussion

Although the current study did not replicate Rubman and Waters' (2000) findings, it did demonstrate that constructing a storyboard improved children's coherence of recall, a proxy measure of mental model coherence, in addition to children's memory for narrative texts. Rubman and Waters (2000) found that children (8 to 9-year-olds and 11 to 12-year-olds) who constructed a storyboard were more likely to monitor their comprehension compared to children who only reread the text, irrespective of age, reading ability and inconsistency type. The lack of replication of Rubman and Waters' (2000) findings in the current study cannot easily be attributed to any methodological differences between the two studies. More specifically, although the current study used a more stringent, binary measure of comprehension monitoring to separately measure children's inconsistency detection and inconsistency correction during recall, comprehension monitoring was also measured using Rubman and Water's original points-based system (a composite measure of inconsistency detection and inconsistency correction during recall) and still failed to show an effect of condition. We predicted that storyboard construction would improve children's recall and encourage more coherent recollections, and indeed, children in the storyboard construction condition recalled more idea units and produced more coherent recalls than children in the reread condition. These findings act to extend our understanding of the benefits of manipulation strategies on children's memory for narrative texts (Berenhaus et al., 2015; Glenberg et al., 2004; Marley & Szabo, 2010; Rubman & Waters, 2000).

Specifically, in addition to the manipulation of 3-D playset pieces on a 3-D playset, manipulating 2-D cut-outs on a 2-D background, while reading a narrative text, also improves children's memory for that narrative text. In addition, this is one of the first studies to demonstrate the usefulness of using a manipulation strategy for improving children's memory of a piece of written discourse, rather than only a collection of action sentences (as in Glenberg et al., 2004; Marley & Szabo, 2010). It is important to note that, in contrast to Rubman and Waters' (2000) study, children were asked to recall the story after the general probe questions rather than the story-specific probe questions, thereby ensuring that children's memory for the story was not affected by text-specific questions.

There is evidence that comprehension monitoring at the discourse-level is causally related to children's ability to form a coherent mental model of a narrative text (Oakhill & Cain, 2012). The current findings suggest that storyboard construction might improve the coherence of children's mental models which, in turn, could also improve their ability to monitor incoming information for consistency (e.g., comprehension monitoring) (Kuperberg, Paczynski, & Ditman, 2011; Rubman & Waters, 2000). This is one of the first studies to explore the usefulness of manipulation strategies for improving the coherence of children's mental models. Previous research investigating the benefits of manipulation strategies for children's reading comprehension has mostly focused on recall, which does not fully capture the connectedness of children's mental models (Glenberg et al., 2004; Marley & Szabo, 2010). The current study defined a coherent recollection as one that read like a story and was truthful to the original text and/or corrected the inconsistency. The benefits of storyboard construction for children's coherence of recall demonstrates the importance of externalisation for constructing an effective mental model of a story (Barnes et al., 2014).

The current study also explored whether the benefits of storyboard construction would persist when the children were encouraged to use an imaginary, rather than actual, storyboard one week later. Its benefits to recall and coherence of recall did not persist during the follow-up session. Unlike the current study, in which children in the storyboard condition were asked to imagine constructing a storyboard one week later for a completely different text, previous research that demonstrated the benefits of imagined manipulation strategies required children to read a similar story (i.e., the same characters and background) to the one they were first trained on (Glenberg et al., 2004; Marley & Szabo, 2010). More importantly, children also had the playset in front of them either right before (Marley & Szabo, 2010) or during (Glenberg, et al., 2004) the imagined manipulation task. Encouraging children to imagine constructing a storyboard without the storyboard in front of them for a story they had never read before may have been too difficult for children in Year 5. Finally, it is also possible that because children did not have a chance to practice SB before the follow-up session that they did not remember how to use the strategy.

Finally, the current study investigated whether children's subjective use of imagery predicted skills related to reading comprehension and predicted that subjective use of imagery would correlate positively with skills related to reading comprehension. We found that subjective use of imagery predicted listening comprehension ability and comprehension monitoring (as measured by Rubman and Water's (2000) 4-point scale) during Session 2. The lack of a correlation between children's subjective use of imagery and performance during Session 1 could be attributed to the fact that children in the SB condition did not need to use mental imagery while reading. Although the current study did not demonstrate consistent benefits of the use of imagery, this result suggests that

using imagery when reading supports (but may not be necessary for) comprehension (Oakhill & Patel, 1991; Sadoski, 1983, 1985).

In the present study, the short durations of the initial and follow-up interventions might have limited the benefits of storyboard construction. Equally, the benefits of storyboard construction might not have persisted one week later because children found it too difficult to apply the strategy to a different story without having the storyboard in front of them. Alternatively, they may not have remembered how to use the strategy. Future research could explore how individual differences in use and application of mental imagery affect the efficacy of storyboard construction and other manipulation strategies. In addition to mental imagery, future research could also explore the effects of other components of children's reading experience (i.e., motor imagery and perspective-taking) on reading comprehension. In conclusion, the current study found that storyboard construction improved children's memory for a story and coherence of recall but that the benefits of the strategy did not have an impact on inconsistency detection and did not persist one week later. The current study also found that spontaneous use of imagery was related to comprehension ability.

Declaration: Chapter 3

Discussions with Prof. Jennifer Rusted inspired the semi-structured interview protocol. Prof. Robin Banerjee (advisor) helped to design the interview protocol and provided preliminary guidance on how to explore the interview data. Dr. Rebecca Graber (advisor) provided guidance through all stages (e.g., coding, presenting the findings) of the thematic analysis. Prof. Alan Garnhham provided feedback on the write-up.

Chapter 3: Children's subjective experiences while reading: links with reading comprehension

Abstract

The extent to which a reader can relate to a story and its characters impacts the person's experience while reading. We conducted a novel, mixed-method study to provide a more child-centric understanding of this phenomenon. In interviews, 25, 9 to 10-year-old children were asked to describe their subjective experiences while reading self-chosen books. A thematic analysis revealed novel insights into children's subjective experience of mental imagery and perspective-taking while reading. Specifically, children tend to adopt an outsider's perspective, visually, whilst simultaneously internalising a character's emotions and physicality. In order to map this finding to objective measures, children were divided into those who reported taking a character's perspective while reading and those who did not. Most notably, participants who reported taking a character's perspective while reading had better memory for narratives. Together, the thematic analysis and statistics support the conclusion that children's reading experience impacts their ability to construct a coherent mental model.

Introduction

The Construction-Integration and Event-Indexing models claim that successful reading comprehension requires the construction of a multi-modal (visual, kinaesthetic, auditory) and multi-dimensional (i.e., made up of spatial, emotional, temporal information) representation of the narrative situation from a particular point-of-view (Johnson-Laird, 1983; Kintsch, 1998;Zwaan, Magliano & Graesser, 1995). Research has established that mental imagery, a person's ability to simulate a scenario by any means (i.e., visualisation, empathy, sound, perspective-taking), is linked to narrative reading comprehension (de Koning, Bos, Wassenburg, & van der Schoot, 2016; de Koning & van der Schoot, 2013; Zwaan, 2014, 2015). Both the positive impact of reading narratives on mental imagery (de Koning et al., 2016; Djikic, Oatley, & Moldoveanu, 2013; Kidd & Castano, 2013; Kurby & Zacks, 2013; Mar, Oatley, & Peterson, 2009) and the positive correlation between subjective use of mental imagery and reading comprehension ability (Boerma, Mol, & Jolles, 2016; Sadoski, 1983, 1985) have been established by previous research. As an example of the former, Kidd and Castano (2013) found that reading literary fiction, compared to nonfiction and "popular" fiction temporarily improved readers' ability "to mentalise," i.e., to understand the mental states (e.g., intentions, desires) of others (Decety & Grèzes, 2006). This improvement was attributed to readers having more opportunities to imagine situations from different perspectives (e.g., the narrator, different characters) as well as to focus on perspectives of multiple characters at once (Kidd & Castano, 2013). In addition, other studies have found that reading any sort of fiction improved readers' ability to empathise, i.e., to feel what another person is feeling (Mar et al., 2009). This finding was more robust for readers who exhibit less openness (Djikic et al., 2013).

In terms of the relationship between subjective use of mental imagery and reading comprehension ability, mental imagery has consistently been found to correlate with comprehension ability (de Koning & van der Schoot, 2013; Sadoski, 1983, 1985). A recent study called this assumption into question by finding that 10 to 12-year-olds' subjective understanding of their mental imagery ability (i.e., measured by a questionnaire) only correlated with their performance on a very specific type of story book: one that requires the reader to integrate text-based and pictorial information to fully comprehend the story being told (Boerma et al., 2016). This peculiar finding may be explained by the authors' simplistic definition of "mental imagery", a combination of mental visualisation (being able to see what is going on in the story) and empathy (to feel what the characters are feeling, which they referred to as "mentalising"). Embodied theories of comprehension suggest that a person's internal experience of reading or listening to a narrative text involves multiple modes of simulation (e.g., touch, sound, feel, sight) in a variety of combinations. Zwaan (2014 and 2015) has provided a theoretical framework for how people simulate what they read and how this relates to past experience and different depths of comprehension.

Reading comprehension intervention research has recently appeared to be dominated by investigations of the benefits of mental imagery training and those of other strategies that encourage readers to apply different modalities (e.g., touch, gesture, emotional expression) to story comprehension (Berenhaus et al., 2015; de Koning et al., 2016; Glenberg et al., 2004). A less explored avenue of the reading comprehension experience is perspective-taking. Specifically, the perspectives that readers adopt while reading stories. What complicates the matter is the possibility that readers adopt a different perspective for different modalities. This possibility is being proposed, because quantitative, experimental research has concluded that children, between the ages of 9 to

16, automatically adopt the visuospatial perspective of the protagonist when reading (Barnes et al., 2014), whilst other studies and researchers have stressed the importance of adopting an outsider's perspective as a sympathetic spectator in order to best understand the emotional plight of characters in a story (Cupchik, Oatley, & Vorderer, 1998; Mar & Oatley, 2008). Excitingly, neuroimaging findings, in combination with behavioural research, has determined that a subset of readers report being able to simultaneously enact *and* observe narrative situations (Hartung et al., 2017).

The aims of the current study were to capture the nuances of 9 to 10-year-old children's subjective experiences while reading and to then explore how those experiences map onto reading comprehension ability. Although mixed-methods studies are rare in the context of cognitive psychology, education research has established a precedent for using rigorous qualitative analyses to help situate Experimental paradigms within children's experience of the world (Aukerman & Chambers Schuldt, 2016; Boerman-Cornell, 2016). By carrying out semi-structured interviews on an opportunistic subset of children from a previous Experimental study (from Chapter 2) and carrying out subsequent follow-up analyses, we hope to begin to construct a more nuanced, grounded and child-centric understanding of children's experience of reading stories.

Method

Participants

25 children (M = 123.16 months, SD = 3.33 months; 18 girls, 7 boys) were selected purposively from the original thirty-five 9 to 10-year-olds (Year 5) who participated in Chapter 2 of this thesis and whose parents/guardians had signed the new permission slips in accordance with the ethics procedure set out by the University Research Ethics Committee. Additionally, each child was informed that they could end

the interview at any point. The sample included an equal number of children from each condition of the previous study (Experimental: 13, Control: 12). Although the interviewer was familiar with the children, she was not reminded of their baseline listening comprehension ability (NARA-II), word reading ability (GM) nor their condition allocation in order to avoid this knowledge impacting the qualitative analysis. The mean/SD NARA-II and GM scores for the 25 children were comparable to the original sample (*Original NARA-II M* = 12.41, *SD* = 6.05; *Interview Sample NARA-II M* = 12.96, *SD* = 6.69; *Original GM M* = 35.96, *SD* = 6.63; *Interview Sample GM M* 35.84, *SD* = 6.72).

Interviews

Participants were interviewed three months after the original Experimental study took place. Interviews were conducted in a private room at the participants' school. The interviewer already worked with the children during the Experimental study and could thus have a friendly rapport with them during the interview. The interviews were semi-structured and included a mix of open-ended and closed questions. The interviews ran between 8 to 20 minutes. At the beginning of the interview, children were asked general questions about their reading experience: whether they enjoyed reading, whether they preferred to read factual or storybooks, what the last storybook they read was, and what part of the storybook they focused on and found most interesting. Although, the purpose of this first part of the interview was to get participants used to thinking about reading, statements from this section were included in the analysis. Next, participants were asked to describe what was going on in their head while reading the most recent storybook they had finished. If the interviewee mentioned "seeing," "imagining," and/or "daydreaming" etc., while reading, they were asked to describe what they saw in their head. The interviewer also asked direct, closed questions to determine whether

children's visualisations (1) were more like still pictures, a movie or a combination of the two (2) detailed or simple (3) focused on the characters, setting, actions/events and/or dialogue. Participants were also asked whether they focused on any character's particular point of view. Participants were also asked whether they thought any of the strategies they mentioned helped them understand what they were reading. Sometimes participants spontaneously addressed these questions without being directly probed to do so. Because the interviews were semi-structured, the interviewer had the opportunity to encourage children to elaborate on certain experiences. The second part, which was considered in the quantitative analysis but not the qualitative analysis (i.e., the protocol discussed so far made up the first part of the interview), consisted of children reading and then, discussing their experience reading a 7-sentence narrative, originally written for the NARA-II (Form A): "Kim stopped on her way to school. In the middle of the traffic lay two children. Their bicycles had crashed into each other. Kim ran quickly to help. She saw that no-one was hurt. The children pointed to the television camera. 'We are taking part in a road safety lesson,' they said" (Neale, 1997). The first author transcribed the interviews. After the interviews were transcribed, a different researcher listened to all of the transcripts and noted if any of the children sounded disengaged, or uninterested during any part of their interview. In addition, she was asked to note any instances of leading questions initiated by the interviewer. Any flagged passages were excluded form subsequent analyses.

Analysis Plan

Thematic Analysis. All participants were considered together for the thematic analysis in order to better understand how children experience narrative texts while reading (Braun & Clark, 2006). Visualisation and perspective-taking were chosen as sensitising concepts to focus the analysis. Each interview transcript was coded

separately for children's subjective experience of visualisation and perspective-taking. The semi-structured interviews were originally designed to capture children's visual experiences while reading. Because the interview questions occasionally asked for closed responses, it was expected that children would potentially use the same vocabulary as the interviewer. With this in mind, the authors did their best to select out the original contributions of the children whilst coding.

The codes derived from the transcripts. Before coding, the first author familiarised herself with the qualitative data by reading through the interview transcripts and collating key words and phrases in N-Vivo. When coding for visualisation, the researcher looked for instances when children described their experiences of visualisation, either by answering closed questions (are the pictures you see in your head still or moving? simple or detailed?) or by elaborating on their responses. The researcher also coded for what parts of a story participants visualised (e.g., actions, descriptions or dialogue), the qualities of text that impact their visualisations (e.g,. imagining illustrations when reading emotional language or more descriptive passages), whether the visualisations are multi-modal (e.g., include the voices of characters) and why participants construct visualisations (e.g., to make the story more interesting, to understand a difficult passage, to personalise the story). When coding for perspective-taking, the researcher looked for instances when participants discussed relating to a character's experience (e.g., thinking about how a character is feeling, feeling what the character is feeling, imagining themselves as a character when reading). The researcher also coded for why participants took a particular perspective (e.g., to understand the story better, to make the story their own) and instances when visualisation and perspective-taking overlapped (e.g., the participant feels what a character is feeling but visualises the story from an outside perspective).

Constructing the themes. A systematic approach was applied to construct the final themes. First, the researcher identified all of the coded passages that corresponded to children's subjective experience of visualisation and collated them in a separate word document. After familiarising herself with the codes, the researcher created a preliminary list of visualisation themes: (1) qualities of text that impact visualisation, (2) how children describe the process of constructing a visualisation and (3) how children describe the experience of visualisation. The preliminary list of themes was used as a starting point to construct a mind map in order to better review the codes and themes. After reviewing the mind map, the researcher was able to generate a final list of visualisation themes that better encapsulated children's subjective experience of visualisation. The aforementioned process was repeated to construct the themes for children's subjective experience of perspective-taking. The preliminary list of perspective-taking themes included: (1) empathic (emotion-based) perspective-taking, (2) visual (spatial-based) perspective-taking and (3) simulative (action-based) perspective-taking. Codes/passages that corresponded to both sensitising concepts were included in both the visualisation and perspective-taking lists of codes. Theme construction involved periodic discussion between the first and second authors in order to review code consistency, theme articulation and agreement between the researchers.

Perspective-taking and reading comprehension. Children were divided into two groups: perspective-takers and non-perspective-takers, in order to conduct follow-up t-tests on measures from the original Experimental study that the children participated in. Six children were excluded from the follow-up analyses because they were flagged as potentially less engaged during the interview. A perspective-taker was defined as a child who reported taking a character in a story's perspective emotionally, cognitively and/or visually. The majority of participants' allocations (i.e., 18 children

out of the 21 children included in the analysis) were confirmed by the second part of the interview, because it gave participants the opportunity to reiterate their reading process in real time (i.e., immediately after reading a short narrative passage).

Baseline measures from Chapter 2.

Neale Analysis of Reading Ability- R (NARA-II) (Form 2) (Neale, 1997)**.** The NARA-II was adopted for use as a listening comprehension assessment and administered to entire classrooms at a time. There were six test stories, of increasing difficulty, read out loud to the students. After hearing each story, children would answer 8 comprehension questions per story in their own answer booklet.

Gates-MacGinite Vocabulary Test (GM) (Level 3) (MacGinite et al., 2000)**.** The GM, a multiple choice vocabulary test with 45 items, was administered immediately after the NARA-II and was used to assess children's word-reading ability. For each question, children had to decide which word (out of a choice of four; e.g., "clean", "at the store", "first" and "near") matched a word or short description (e.g., "they are close").

Imagery. To assess children's subjective use of imagery when reading normally, children were asked "when you are reading books, even when they don't have pictures in them, do you see pictures in your mind of what you're reading?" Children chose one of five responses on a Likert scale: never, rarely, sometimes, a lot or always. This question was asked at the beginning of Sessions 1 and 2. The measure used in analyses was an average of the two responses.

Experimental measures from Chapter 2.

The measures discussed below were collected after participants read one of two stories, *Different Fish* or *Al's Room*, with an internal inconsistency. The stories were originally used in Rubman and Waters (2000). Participants who read *Different Fish*

during Session 1, read *Al's Room* during Session 2 and visa versa. During Session 1, children in the Experimental condition created a storyboard while reading; controls read the story as normal. During Session 2, children in the Experimental condition were asked to imagine creating a storyboard while reading; again, controls read the story as normal. There were no significant differences in performance between conditions during Session 2. Children's scores during both sessions were included in the current study.

Comprehension Monitoring. The 4-point scale is based on the one used in Rubman and Waters' (2000): children were awarded 4 points if they detected the inconsistency outright (after being asked "Did everything the story make sense?" and "Was there anything wrong with the story" immediately after reading the text), 3 points if they detected/corrected the inconsistency during recall, 2 points if they detected/corrected the inconsistency during story-specific probe questions and 1 point if they failed to notice the inconsistency. Children's scores were used in a supplementary analysis in Berenhaus, Oakhill and Rusted (Chapter 2), because binary measures were used to differentiate between inconsistency detection and inconsistency correction during recall.

Recall. Recall was measured by percentage of idea units recalled. See Appendix III from Chapter 2 for the protocol used to score recall. An "idea unit" is defined as the smallest unit of content in a text. Two raters independently divided the two test stories, *Different Fish* and *Al's Room*, into idea units and discussed any discrepancies, Kappa = .91, $p < .001$. *Different Fish* was divided into 24 idea units and *Al's Room* was divided into 29 idea units.

Coherence of Recall. Two raters independently scored each transcript for coherence (from 1-5 for each session), Kappa (first session) = .92, $p < .001$; Kappa

(follow-up session) = .96, $p < .001$. A protocol for scoring coherence of recall can be found in Appendix IV from Chapter 2. A score of one was given to recall transcripts that had no correct information from the story and a score of 5 if the transcript maintained the causal structure of the story and included connectives. It is important to note that the coherence of recall measure was subjective (5-point scale), but double coded, and not based on the exact number of connectives within each recollection.

Results

1. Thematic Analysis

A list of the themes for both sensitising concepts are listed in Table 1 in addition to a short summary of children's experiences for each theme.

Table 1

Summary of mental imagery and perspective-taking themes

Themes	Children's Experience
Mental imagery themes	
1. Reasons for imagining while reading	• Allowed them to personally connect with a story and make it his/her own • Helped them fill in gaps of understanding and elaborate on the text • Helped them ground the text in reality
2. Descriptions of mental images	• Mental images could be multi-modal and dynamic • Mental images are not only visual
Perspective-taking themes	
3. Visualise to take perspective	• They reported visualising stories from an outside perspective • And taking a character's perspective by embodying their emotions and/or actions (while also taking an outside, *visual* perspective)
4. Simulate action to take perspective	• Perspective-taking can focus on simulating the protagonist's actions • Simulation can help them make the character's actions their own and/or understand a difficult passage
5. Feel to take perspective	• They reported imagining how a character felt and/or feeling the character's emotions themselves • Thinking about a character's emotions helped

	them envision how that character would tell the narrative • Comparing a character's experience to their own could help them understand the story better

Theme 1: Reasons for imagining while reading. We first focused on the reasons children gave for using their imagination while reading. Notably, every child interviewed reported at least one experience of mental imagery while reading, although some participants said they would only use imagery when reading narrative texts under certain circumstances (e.g., when the language provoked emotion or they really enjoyed what they were reading).

The analysis found that children reported visualising in order to personally connect with a story and make it their own. For example, Sarah[5] mentioned she visualised while reading, even without an interview prompt:

> INTERVIEWER: what do you enjoy about reading?
> SARAH: well I like imagining the pictures if there aren't any pictures and imagining the characters and finding out what the story is about and then if there are pictures I go along with the pictures because then I can see what's happening in the story as well as reading…because then they can be my own characters

The fact that Sarah spontaneously mentioned she imagined illustrations and characters, which was why she enjoyed reading, suggested mental imagery was fundamental to her enjoyment (and speculatively, her understanding) of a story. She also mentioned in this excerpt that she preferred imagining her own pictures. This point suggested that personally connecting with a story's content was also important for Sarah's enjoyment and understanding of a narrative text (and perhaps the reason why she used mental imagery as a reading strategy).

The analysis also found that mental imagery helped the reader elaborate on the text and fill gaps in their understanding. For example, although Jenny never explicitly

[5] Participants' names were changed to protect their identities.

mentioned seeing pictures in her head, she did report "daydreaming," which, in this context, appeared to fill the same role as visualising or imagining:

> JENNY: I've just been daydreaming trying to think what it would be like to have a tramp in your house and your shed
> INTERVIEWER: Can you give a specific example…?
> JENNY: When…her little sister was doing [the character's[6]] makeup and I wondered what he would look like

In a similar vain to why Sarah visualised, Jenny daydreamed in order to relate to what was going on in the story, i.e., what would it be like for *her* to have a street person in the house. The latter half of the excerpt suggested that her daydreaming can be constructive and help the reader fill in the blanks, e.g., imagine how a character's appearance has changed.

Like Jenny, Sarah also argued that visualising helped her fill in the blanks ('well if there wasn't any pictures in the book and there was just a little bit of description you can see in your head what you think the characters would look like and you can see what you think they'd be doing. So it's kind of explaining the story a bit more').

The analysis also suggested that mental imagery helped the reader compare the text, not only to personal experience, but to the world, in general. For example, Amy, 'Because there was a lot of people in it, I was imagining what it was actually like in the land.' Amy's wording (i.e., 'what it was *actually* like') suggested constructing mental images helped her to ground the text in reality and that her imaginative mental images were not limited to visual information. For example, they could also include, for example, kinaesthetic and audio information.

[6] Information connecting transcript excerpts to the books discussed were removed or altered to protect the anonymity of participants.

Theme 2: Descriptions of mental images. Like Amy, many of the interviewees described experiencing multi-modal mental images while reading. For example, Matt alluded to imagining the story's setting:

> INTERVIEWER: Can you describe what was going on in your head…?
> MATT: Well there were no pictures so I thought of [the characters], and they were down in their basement when they talked, like their secret club house. So I thought they were in quite a big room, chatting about what was gonna happen.
> INTERVIEWER: … Did you kind of see that like a picture?
> MATT: Yea.
> INTERVIEWER: And was it more like a still picture or a movie?
> MATT: It was like a movie.
> INTERVIEWER: … Was the movie rather detailed or was it simple?
> MATT: It was quite detailed, quite a lot of colors and really good…It looks real life

Despite the absence of illustrations (or maybe because of it), Matt experienced mental images that were colourful, like a 'really good' movie that looked like real life. For Matt, visualising text allowed him to elaborate on the story (e.g., the setting of the story and actions of the characters) and imagine what the characters would sound like:

> INTERVIEWER: And when you…said you…focus on conversations between characters, do you kind of hear voices in your head …?
> MATT: … I see the picture and I hear the voices while they're talking in my head.
> INTERVIEWER: And do you make up voices or is it kind of…what exactly are the voices?
> MATT: It's what I think they sound like and they're saying what it says in the book, like when I think of the word in my head, they say it in my head.

It is significant that Matt, as well as other children, reported multi-modal experiences of mental imagery, because the analysis revealed that experiences of mental imagery were not always only visual. For example, Scarlett discussed her experience reading:

> SCARLETT: I see rosebushes because it mentions about rosebushes and so I think about rosebushes and flowers blooming and foxes and cubs coming
> INTERVIEWER: … What other things are you thinking about when you're reading …?
> SCARLETT: how they're feeling and how they're doing it

INTERVIEWER: How they're doing it? What do you mean?
SCARLETT: um if they're doing it as in rushing or slowly… [character A] was rushing as he was bringing the animals together to see [character B]
INTERVIEWER: ….You mentioned what the characters are feeling, can you give me an example of that?
SCARLETT: first [character C] was really struggling, she was feeling really anxious, now she's feeling really confident and happy
INTERVIEWER: And with those kind of emotions the characters are feeling, how do you approach them? Do you feel them yourself or do you just think about them feeling it?
SCARLETT: I just think about them feeling it

In addition to visualising what she read, Scarlett also thought about the protagonist's emotional shifts over the course of the story. She explained that rather than feeling the emotions herself, she only thought about how characters are feeling. Like other interviewees, Scarlett explained that depending on what she was reading, she sometimes saw a movie and other times, a series of pictures:

SCARLETT: sometimes it's like picture picture and sometimes it's like a scene
INTERVIEWER: when is it picture picture picture?
SCARLETT: normally when It's talking about the same thing in one long paragraph
INTERVIEWER: Ok and when is it more a movie
SCARLETT: when you hear some of the words and it sounds like it's going on like a movie. Like when there's lots of speech going.

More specifically, she saw pictures in her head when the text was very descriptive and a movie when there was a lot of dialogue. In addition, like Matthew, she also heard characters' voices in her head.

Theme 3: Visualise to take perspective. One unexpected finding from the analysis was that most children reported that they visualised stories from an outside perspective (as opposed to the protagonist's point of view).

Alfred was the only interviewee who reported visualising narrative texts from the first-person perspective (although, from this excerpt one can really only conclude that Alfred at least 'experienced' the story from a first-person perspective):

INTERVIEWER: And do you ever focus on any characters point of view when you're reading?
ALFRED: Yes.
INTERVIEWER: Yes? Can you elaborate on that?
ALFRED: Well normally think about what they will be feeling like and also I'd try to picture it as if I was literally them, so I would be looking like this instead of it being in third person.
INTERVIEWER: Ok. And does that help you kind of understand what you're reading?
ALFRED: Yes.
INTERVIEWER: How so?
ALFRED: It makes it feel like it's actually real life, like, yeah.

Like Matt (see Theme 2), Alfred's mental imagery felt like "real life" but unlike Matt who visualised his story from an outside perspective, Alfred *possibly* visualised the story from the protagonist's point-of-view. This was not the norm. Instead, most children visualised stories from an outside perspective and/or simulated the *emotions* and/or *actions* of characters. The following example exemplifies the former strategy:

INTERVIEWER: …Do you ever focus on any character's particular point of view?
LEAH: I usually focus on all of them.
INTERVIEWER: …Does that help you understand what you're reading?
LEAH: yea
INTERVIEWER: In what way?
LEAH: Well, then I know what the characters are and what's happening.

When prompted, Leah explained that taking an outside perspective allowed her to visualise, presumably, where the characters were, spatially, and what they were doing. One could extrapolate that taking the outside visual perspective allowed the reader to have a more general understanding of a story's spatial layout. Similarly, Amy also took an outside perspective when visualising what she was reading:

INTERVIEWER: …Do you ever see [the story] from a particular point of view of a character?
AMY: yea
INTERVIEWER: Yea? Can you give me an example and describe that
AMY: [the character's] view because she's the main character and she's in the land.

> INTERVIEWER: And do you see it from her eyes or are you still seeing it from a more general perspective?
> AMY: A more general perspective.
> INTERVIEWER: And how do you take her point of view? In what way?
> AMY: Like I'm above her and yea.
> INTERVIEWER: And so do you imagine yourself as her?
> AMY: [assumed head nod]
> INTERVIEWER: in what way?
> AMY: I imagine myself in her boots.
> INTERVIEWER: But you don't see it from her eyes. Does imaging yourself as her help you understand the story at all?
> AMY: [assumed head nod]
> INTERVIEWER: In what way?
> AMY: to see what she's going through

Interestingly, Amy imagined herself as the protagonist but *visualised* the story from an outside, "more general" perspective. Amy also contended that imagining herself as the protagonist helped her understand what the character was going through.

Theme 4: Physicalise to take perspective. Like Amy, almost half of the 25 interviewees reported imagining themselves as characters. Specifically, the analysis found that Perspective-taking could focus on simulating the protagonist's actions. For example, Katie *spontaneously* reported imaging herself as a character while reading:

> INTERVIEWER: Ok cool, and can you describe what was going on in your head …?
> KATIE: I was imagining that I was the girl and I had a cat and when I read it I was thinking how I would tell my cat off if he kept bringing dead mouses and stuff in the house and how I would tell him and how I would respond to the cat.

During her interview, Katie, described imagining herself as, presumably, the protagonist in the book she was reading. There were two important characteristics of word-choice to point out: first, Katie's perspective-taking focused on actions; specifically, how she would physicalise the protagonist's performance (i.e., what she would say and how she would respond to her cat's behaviour). Secondly, Katie's use of personal pronouns suggests she used simulation in order to make the character's actions her own (e.g., "I was thinking how *I* would tell him")..

The analysis also found that simulating action could help the reader make the character's actions their own and/or understand a difficult passage better. For example, immediately after the previous discussion, the interviewer asked Katie whether she thought perspective-taking helped her understand what she was reading:

> KATIE: Uh it helped me understand the book because some parts are complicated so you don't understand what's going on so it might just be loads of words but you don't really understand it but by putting yourself in the characters shoes a bit more, it helps you get an idea for that page or two pages might be talking about because if you don't know what they mean you can like look at them in your head and you can get an idea of what they might be. And sometimes there's pages that don't make any sense and there's lots of powerful language and you're with your mum and you go through it with your mum says it doesn't make any sense of it putting yourself in the character or the cat or whatever, any character, then you'll get an idea
> INTERVIEWER: Can you give me an example of when you did that?
> KATIE: There was a part when there were loads of words and I thought that I was the cat and I was in the bush and destroying the plants but it didn't actually say those, it didn't make it clear enough that he was in the bushes and so we um I put myself in the cats shoes and just imagined that I was in the bushes and thing destroying my mum's plants.

It was interesting to note that Katie *also* imagined herself as the cat in the story and performing actions not explicitly mentioned in the text. Similar to Sarah and Jenny, Katie used simulation to elaborate on what was said in the text ('I thought that I was the cat and I was in the bush and destroying the plants <u>but it didn't actually say those'</u>) in an attempt to understand a difficult passage. She also explicitly stated that visualising a passage and imagining herself as characters both helped her understand difficult passages. It is important to note that from these excerpts alone, it was difficult to conclude what elements of mental imagery and/or simulation helped the reader better understand what they were reading (if it all). Later in the interview, when asked how she visualised speech, Katie continued to describe simulating characters' actions:

> KATIE: Say I was the girl, I was the cat's owner, I would visualise it if I was talking to my mum and I'd actually visualise me talking and thinking and basically the words that are in the there, making them my own words but meaning the same thing.

When asked how she would visualise speech, Katie said she would imagine herself thinking and speaking as if she were the character, making the words her own. This also demonstrated how she was able to personalise the reading experience.

Theme 5: Feel to take perspective. In addition to simulating characters' actions and dialogue, children reported relating to what they were reading by imagining how characters felt during certain scenes. For example:

> LAUREN : … when I was reading [the book], there was this girl called [the character] and she wanted to be a witch and then she went in for the […] witch trials. Then when she started feeling like she didn't want to do it anymore because she wanted to go back to her home and I started imagining what she would be feeling. I imagined that she would probably be feeling a bit upset.
> INTERVIEWER: At any point did you see the story from her eyes? Or did you see it more from a third person perspective?
> LAUREN : I saw it more from a third person's perspective.

Lauren described imagining how the protagonist, Sam, might be feeling, while reading. It is important to note that, similar to children who reported simulating characters' actions, Lauren also reported visualising the story from an outside perspective.

The analysis also revealed that thinking about a character's emotions could help the reader envision how that character would tell the narrative. For example, Later in the interview, Lauren discussed how imagining what a character was feeling helped her to understand a story:

> LAUREN: It just makes me understand what their facial expressions would be. If they were telling the story themselves, how they would tell it.
> INTERVIEWER: Ok, what do you mean by that?
> LAUREN: Like, you know in some books like when some books they're supposed to be writing a story? Well when I start thinking about what the characters might be feeling, I imagine what it would be like if they were telling the story. …
> LAUREN: Well when I was reading [the book], when I was feeling that [the character] might be feeling a bit upset then I started imagining if she was writing the story that she might be feeling, she might be saying well when I went in for the […][2] witch trials, I started feeling a bit upset part way though because I realised I didn't want to be the [best] witch anymore.

Lauren explained that feeling how a character was feeling allowed her to envision the character's facial expressions and how the character would tell the story from his/her point of view. One could predict that Lauren's strategy of envisioning how a character would tell his/her version of events could potentially help her have a better understanding of the story's characters and the story itself.

A subset of children, the majority of which reported simulating character's actions, also described feeling what they were feeling. For example:

> DYLAN: […] I can see their smiles moving up and down and that and it's quite emotive which is what I like because I like thinking illustrations for emotive for emotive stories.
> INTERVIEWER: And is it cus you feel the emotions yourself? Or is it just because you enjoy thinking about other people's emotions?
> DYLAN: It's sort of both of them really because I do like feeling people's emotions from books and it's because I feel the emotions myself as well because sometimes while I'm reading a really good book, I imagine that I'm that character. And that's why I feel their emotions.

Dylan explained that when he imagined himself as a character in a book he both thought about and felt what the character was feeling. It appeared that empathising with a character (i.e., feeling what he/she is feeling) could potentially help the reader understand what they were reading in a slightly different way than just *thinking* about a character's feelings.

The analysis also unveiled that comparing a character's experience to the reader's own could help them understand the story better. For example, Dylan also explained that he tried to relate to characters' experiences:

> DYLAN: I try to relate to it, like if its happened to me so like I found something on the floor and then I get bullied to have it. Like say I found a 5 pound note on the floor cus I did once and people bullied me to have it and that's what happens in the story, so I tried to kind of relate to it sometimes if I can.
> INTERVIEWER: Ah interesting, and what do you think the benefit is of relating to the text?

> DYLAN: I think the benefit of relating to the text is you know what's happening in the story because you've been through it yourself so you know how those characters are feeling and that.
> INTERVIEWER: And does it help you understand the text?
> DYLAN: Yea it does because I know what the text means though because I've been through it myself so I know how people feel and that so I know what the text means.

Although it was uncertain at what point in the reading process this strategy took place (while or after reading), it was clear that Dylan actively tried to make connections between his own past experiences and the story. He also claimed that he better understood the content of the story if he could relate to it himself. It was important to note that this thread of relating to the story and making it one's own was seen throughout this analysis.

2. Perspective-taking and reading comprehension.

To remind the reader, the aim of the follow-up quantitative analysis was to determine whether a categorisation (i.e., perspective- takers versus non-perspective-takers) derived from qualitative data could predict performance scores. After children were divided into perspective-takers (PT) and non-perspective-takers (NPT), we compared children's performance on measures from the original Experimental study (see Table 2) using t-tests.

Table 2

Condition allocation and performance during Chapter 2 as a function of perspective-taking

	Perspective-Takers		Non-Perspective-Takers			
N	14		7			
Condition (Exp. 1)	SB	Control	SB	Control		
# of children	9	5	5	2		
Measure (total)	*M*	*SD*	*M*	*SD*	*t*(d.f.)	*p*
NARA-II: Listening Comprehension (40)	15.18	6.59	9.21	6.10	2.00(19)	.060
GM: Word reading (45)	37.64	5.80	33.57	8.52	1.30(19)	.210
Imagery (5)	4.14	0.86	3.07	1.30	2.26(19)	.036

Session 1 (SB training)						
Comprehension Monitoring (4)	2.57	0.85	2.00	0.82	1.47(19)	.158
Recall (%)*	40.03	18.86	30.13	9.28	1.61(18.99)	.124
Coherence of Recall (5)	3.00	1.04	2.43	0.98	1.21(19)	.240
Follow-up (no strategy)						
Comprehension Monitoring (4)	2.85	1.07	2.29	1.38	1.01(18)	.325
Recall (%)	41.51	12.86	20.79	13.40	3.39	.003
Coherence of Recall (5)	3.15	0.99	1.71	0.76	3.35	.004

*****Equal variances not assumed, $F = 5.69$, $p = .028$

The analyses revealed that children who were identified as perspective-takers had close-to-significantly better baseline listening comprehension performance (NARA-II) and reported using mental imagery significantly more often than children identified as non-perspective-takers. In addition, PTs remembered significantly more of the Experimental narrative texts (percentage of idea units, "Recall") and had more coherent recollections (scale: 1-5; scored by two independent raters) during Session 2 than NPTs.

Discussion

The aims of the current study were to capture the nuances of 9 to 10-year-old children's *own* experiences while reading and to then explore how those experiences map onto their reading comprehension ability. Perspective-taking, whether a child reported taking a fictional character's point-of-view emotionally, cognitively and/or visually, was chosen as the grouping variable for the follow-up, quantitative analyses. It was chosen because of the richness of children's interview responses and because of how well they map onto previous research (Barnes et al., 2014; Cupchik et al., 1998; Hartung et al., 2017; Mar & Oatley, 2008). In regards to the study's first sensitising term, children's experience of mental imagery, the thematic analysis revealed its multi-modal qualities. For example, while visualising what was happening in a story, children reported hearing background noises as well as characters' voices.

The theme of multi-modality also relates to children's experience of perspective-taking. Specifically, the analysis unmasked three different modes of perspective-taking: visual ("visualise to take perspective"), physical ("simulate action to take perspective") and emotional ("feel to take perspective"). They all appear to be used in combination, or on their own. More interestingly, if a child used more than one perspective-taking strategy (e.g., visual and motoric) the vantage point (outside perspective versus seeing the story from the character's perspective) would frequently differ between modalities. For example, it was quite common for participants to report taking an outside perspective, visually, while simultaneously stepping into a character's shoes emotionally and/or physically. This conclusion maps onto Mar and Oatley's (2008) contention that readers are better able to empathise with a character from monitoring their intensions as an outsider/audience-member than from imagining themselves to be the character. Perhaps, participant's emotional and physical perspective-taking was the result of successfully understanding a character's intentions (originally developed from an outsider's perspective). Thus, it is not surprising that children who reported taking a character's perspective during the interview had better memory for the test stories and recalled them more coherently, because they were potentially more cognitively and emotionally engaged, which is thought to enhance comprehension (Yeari & van den Broek, 2011; Zwaan, 2014).

The fact that the majority of children reported adopting an outsider's perspective of the narrative situation while reading, visually, is in direct contrast with conclusions from a previous quantitative study (Barnes et al., 2014). This could mean that what children report seeing in their mind's eye, while reading, is not from the same perspective as what readers automatically simulate in order to create the visuospatial dimension of their mental models. Thus, these results suggest that in order to fully

grasp the nuanced experiences of readers and the extent to which those experiences map onto performance, more creative, possibly mixed-method methodologies need to be implemented. In terms of limitations to the current study, it is important to remind the reader that these conclusions are only based on a small sample of 25 British, 9 to 10-year-old students. In addition, the semi-structured interview protocol could have included more open-ended questions to ensure that participants were providing their own responses to each question, rather than having to choose from a select number of responses given to them by the interviewer. Furthermore, the interview protocol was not designed specifically to deconstruct the nuances of children's perspective-taking process when reading stories. Thus, the questions could have done a better job of attempting to unpack children's experiences. In addition, although the interviews revealed that different children have different approaches to experiencing stories, the design was not appropriate to adequately group children into certain types of perspective-takers. Thus, the findings provide a good starting point for further exploration into the nuances of perspective-taking whilst reading fiction, rather than firm conclusions. Firstly, a starting point for future research would be to tighten the definitions of mental imagery and perspective-taking. Specifically, that in order to best break down readers' experience of mental imagery and perspective-taking, researchers need to first have a firm understanding of *what*, exactly, mental imagery and perspective-taking *are*. Secondly, the qualitative findings from this study as well as future findings could be used to create an intervention protocol that takes into account the variety of ways children experience and relate to narrative texts. Thirdly, using an approach similar to Rapp, Broek, McMaster, Kendeou and Espin (2007), it would be interesting to use data from an interview protocol, in combination with behavioural

measures, to categorise children into various types of experiencers and perspective-takers, in order to extend our understanding of the reading comprehension experience.

Declaration: Chapter 4

Prof. Jennifer Rusted (supervisor) and Prof. Jane Oakhill provided input on the study design, analyses and write-up. Prof. Alan Garnham (supervisor) provided input on the analyses and write-up.

Chapter 4: Keeping stories grounded: A longitudinal exploration of the effects of reading strategies on children's comprehension of narrative texts

Abstract

The current study aimed to measure the short and long-term effects of two reading strategies, storyboard construction (SB) and active experiencing (AE), on children's memory for and comprehension of stories. It was predicted that immediately after training, both strategies would improve children's memory for stories compared to controls, AE would improve children's comprehension of emotional information compared to other conditions and SB would improve children's comprehension of spatial information compared to other conditions. Fifty-six 9 to 10-year-olds were recruited. During the first session (T1), one-third of participants were trained to use SB, one-third to use AE and the rest received no specific training (Waitlist Controls (WLs)). After training, participants read short stories, using their respective strategy, and then recalled each story and answered comprehension questions. Three months later (T2), WLs were trained to use the more beneficial strategy, SB, with the same procedure as Session 1, while children in the original strategy conditions imagined using their strategies while reading short stories. Three months after that (T3), children in all three conditions imagined using their strategies. The same memory and comprehension tests were applied at T2 and T3 as T1. Immediately after training, children who used SB had improved memory for stories and comprehension of spatial information, while children who used AE had improved performance on emotional information. The most compelling evidence for children maintaining the benefits of their strategy three months after training is WLs still having improved recall, originally obtained at T2, compared to T1 during T3.

Introduction

Successful reading comprehension involves the construction of a mental model, a multi-modal representation of the narrative situation from a particular point-of-view (Johnson-Laird, 1983). Skills required to construct a mental model of a text include making inferences to establish local (between two sentences) and global (understanding the text overall) coherence, and continually updating one's mental model based on current information from the text and one's background knowledge (for a review see Oakhill, Berenhaus & Cain, 2015). Although years of research have demonstrated how causally important discourse-level comprehension skills, like inference making, are for children's reading comprehension, the National UK curriculum has only just started emphasising their necessity in the classroom. Thus, the value of developing strategies to improve discourse-level comprehension skills, specifically, in the classroom is significant.

In terms of story comprehension, the event-indexing model argues that readers construct and update their mental models along five dimensions: time, space, causation, motivation and character (Zwaan, Magliano, & Graesser, 1995; Zwaan & Radvansky, 1998). For example, when reading about the movements of a character (e.g., through a marketplace), both children and adults continually update the character's location within their mental model (i.e., the spatial dimension) based on literal and inferred information in the text (Barnes et al., 2014; Rall & Harris, 2000; Ziegler, Mitchell, & Currie, 2005). Mental representations of stories also include second-order dimensions, those that cannot exist without first order dimensions (i.e., emotion information cannot exist without protagonist information) (Therriault & Rinck, 2007; Wassenburg, Beker, et al., 2015).

Studies focused solely on the spatial dimension of narrative comprehension are over-represented in the literature compared to other dimensions, because mental models are assumed to be spatially organised (Barnes et al., 2014; Cutica, Ianì, & Bucciarelli, 2014; Glenberg, Meyer & Lindem, 1987). Interestingly, recent research has suggested that children (8 to 13-year-olds) do not automatically monitor their understanding of spatial (and temporal) information while reading but do so for emotional and causal information (Wassenburg, Beker, et al., 2015). In addition, adults do not automatically activate spatial information in a mental model while reading narrative texts unless explicitly asked to focus on spatial information (Hakala, 1999). Thus, whilst mental models are spatially organised, the spatial dimension may either be more difficult for readers to keep track of or not automatically considered essential for understanding narrative texts. In addition to the event-indexing model, embodied theories of reading comprehension include a theoretical framework for multi-modal mental model construction; specifically, the claim that constructing a mental model involves (re)activating the motoric, sensory and affective neuronal systems involved in simulating what was described in the text (Barsalou, 2008; de Koning, Bos, Wassenburg, & van der Schoot, 2016; Glenberg, 2011; Niedenthal, 2007; Zwaan, 2015), which is supported by neuroimaging evidence (Chow et al., 2013; Kurby & Zacks, 2013; Nijhof & Willems, 2015). Thus, visual and motoric traces are either required (i.e., radical embodiment) or at least enhance (i.e., grounding by interaction) higher cognitive processes (Mahon & Caramazza, 2008). Strategies that engage sensorimotor and affective processes, either through physical simulation (e.g., manipulating playset pieces) or mental imagery training, have been found to improve skills related to reading comprehension in children and adults. The current study focused on comparing the benefits of two physical simulation strategies: active

experiencing (AE) and storyboard construction (SB), on children's (9 to 10-year-olds) memory and comprehension of stories and looked at the extent to which their benefits could be maintained through mental imagery. Mental imagery is the ability to visualise and simulate a story's content as well as to empathise (also known as "mentalise") with its characters (Boerma, 2016). Encouraging children to convert physical simulation into mental imagery is essential for them to continue using these strategies (outside of experimental conditions). To date, no study has explored the extent to which children can maintain the benefits of physical simulation strategies over a longer period of time (e.g., an academic year).

The first strategy the current study focused on is active experiencing (AE), the act of becoming cognitively, emotionally and physiologically engrossed in communicating a text to another person (or audience member) (Noice & Noice, 2001). AE was originally applied in the context of theatre and requires an actor to fully commit to their character's intention (e.g., to flatter, to threaten), thus encouraging empathy (Noice & Noice, 2001). If applied during encoding, this strategy has been found to improve undergraduates' (with minimal acting experience) memory for lines in a play compared to intentionally memorising the lines (Noice & Noice, 2001). In the context of children's reading comprehension of narrative texts, Berenhaus, Oakhill, and Rusted (2015) found that encouraging children (7 to 11-year-old) to act out a story using emotional expression and movement, while reading the story out loud, improved their memory for descriptive information in the text. In order to extend previous research, the current study will also examine the effects of asking children to *imagine* using AE on comprehension, while reading. It is difficult to predict exactly what form children's imagined AE will take, because, to our knowledge, no previous study has examined the effects of asking children to imagine gesturing/moving and using emotional expression.

It is important to note that traditional AE already involves internalisation; specifically, Berenhaus and colleagues (2015) argued "AE encourage[s] children to adopt the gesture and emotional conviction of a story's various characters" and "to adopt a first-person perspective" (p. 340). Thus, one could predict that imagined AE would involve an increase in emotionally-driven and character-driven internalisation.

Although no study has explored the usefulness of AE or *imagined* AE for improving children's *comprehension* of narrative texts (separate from recall), past research has demonstrated the benefits of drama-based strategies and gesture on reading comprehension and learning, more generally (Cutica et al., 2014; Rose, Parks, Androes, & McMahon, 2000). In terms of drama-based strategies, one strategy that was found to be particularly effective was *Reading Comprehension through Drama (RCD)* (Rose et al., 2000). The program was extensive: carried out over 20 days and broken down into four stages where children were encouraged to focus on different elements of narrative texts (e.g., the story element, the perception element). They would read stories and then re-enact the different elements using cut-outs or themselves. For example, during the perception stage, children would act out a story with a focus on what sensations the characters might be feeling. This encouraged them to elaborate on the story and physically simulate the experience of the characters. Notably, RCD aimed to improve children's mental imagery in order for children to maintain the benefits of the training. The strategy was found to improve children's overall comprehension.

In the context of gesture, there is a large body of research demonstrating the benefits of gesture for learning new information, which could arguably be applied to children's memory for stories as well as discourse comprehension skills like inference making (for a review see Novack & Goldin-Meadow, 2015). For example, Cook, Mitchell and Goldin-Meadow (2008) found that, out of a group of children (8 to 10-year-olds) who

were unable to complete a type of math problem, those that gestured whilst practicing a new strategy were more likely to retain what they learned one month later than those who only practiced the strategy verbally. In terms of *how* gesture benefits learning, gesture may be causally implicated in the learning process (Broaders, Cook, Mitchell, & Goldin-Meadow, 2007; Beaudoin-Ryan & Goldin Meadow, 2014). For example, Broaders et al. (2007) found that children who gestured whilst solving math problems were more likely to use novel strategies, which correlated with them retaining what they learned. This is thought to be because children cultivate and express implicit knowledge through gesture, which then primes them for learning (Novack & Goldin-Meadow, 2015). These findings align with an embodied approach to cognition by demonstrating that constructing a mental representation of an abstract concept benefits from (if not requires) a motoric component.

Bridging the gap between learning and reading comprehension, Cutica (2014) found that encouraging 10-year-old children to gesture whilst reading an expository text about a science concept (e.g., the circulatory system) increased the number of correct (non-literal) idea units they remembered from the text and the number of discourse inferences they spontaneously generated at recall. In a second study, Cutica (2014) also found that children who gestured whilst reading were more likely to misidentify paraphrases as original sentences from the text. The results were interpreted as evidence that gesturing whilst reading helped children form a more articulated mental model of the text. The second physical simulation strategy the current study focused on is storyboard construction (SB), the active recreation of a story where a child manipulates 2-D plastic cut-outs to act out what is going on in the story. Manipulation strategies are thought to benefit children's comprehension by encouraging them to map words and phrases to objects, derive the object's affordances and mesh the affordances into a doable set of

actions as directed by the sentence's syntax (Glenberg & Robertson, 1999). The Indexical Hypothesis argues that this process, known as indexing, is how children first approach word learning (Glenberg & Robertson, 1999).

Previous research has demonstrated that children (8 to 12-year-olds) who used SB while reading were better at noticing inconsistencies in the text and then recalling the text (Rubman & Waters, 2000). The benefit of SB for inconsistency detection suggests that the strategy may be helping children to integrate information in the text, a discourse-level comprehension skill. Chapter 2 of this thesis also found that children (9 to 10 years old) who used SB had better coherence of recall, a proxy measure of mental model coherence. Other manipulation strategies (acting out a story using a 3-D playset) have also been found to improve young children's memory for story content and performance on literal comprehension questions. It is important to note that very few studies have looked at the benefits of SB and other manipulation on discourse-level comprehension skills (e.g., inference making), apart from comprehension monitoring. Interestingly, Glenberg, Gutierrez, Levin, Japuntich and Kaschak, (2004) found that manipulation improved children's performance on spatial inference questions that required them to integrate information they read in the text with information they could see in the playset (control participants would also look at the playset), but apart from Rubman and Waters (2000), no studies have explored the effects of manipulation strategies on children's ability to integrate information in the text, a skill that is causally implicated in successful reading comprehension (Oakhill & Cain, 2012).

In terms of converting physical simulation into mental imagery, Glenberg et al. (2004) and Marley and Szabo (2010) both demonstrated that children can maintain the benefits of physical manipulation when encouraged to imagine using the strategy. To our knowledge, no previous study as explored the benefits of imagined AE. One of the

reasons the current study explored children's ability to maintain the benefits of physical strategies by imagining using the strategy is because it would allow them to use the strategy when reading on their own. Also, physical strategies are thought to be conducive for encouraging mental imagery because they provide readers with sensorimotor experiences to simulate what is going on in the text (de Koning et al., 2016; de Koning & van der Schoot, 2013).

The current study aimed to compare the benefits of AE and SB on children's memory for narrative texts as well as their literal and inference-based comprehension of emotional and spatial information. Because previous research suggests that the benefits of physical simulation strategies could be maintained without the use of props by encouraging participants to imagine using the strategy, the current study also aimed to explore whether children would be able to sustain the benefits of the strategies throughout the academic year (Glenberg et al., 2004; Marley & Szabo, 2010). At the beginning of the year, children were allocated to one of three conditions: SB training, AE training or a Waitlist (WL) control group. For ethical considerations, children allocated to the WL condition acted as a control during the first time point (T1) but were trained to use the more beneficial strategy, which was determined to be Storyboard Construction, during T2. During the test sessions, children read two short narrative texts, recalled the stories and answered comprehension questions.

Predictions

Immediate Benefits: At T1, it was predicted that children in the SB and AE training conditions would recall more from the test stories than children in the WL condition. Because AE encourages children to focus on emotional information, it was predicted that children in the AE condition would answer more emotion comprehension questions correctly than those in the SB or WL conditions. Similarly, because the SB

condition encourages children to focus on spatial information, it was predicted that children in the SB condition would perform better on spatial comprehension questions than those in the AE or WL conditions. It was also predicted that AE and SB would improve children's performance on literal and inference-based comprehension questions to the same extent, because similar strategies have been found to improve both children's memory for literal information and their ability to construct an integrated mental model of a text.

Long-term Benefits: Because no previous study has measured the long-term benefits of SB or AE on reading comprehension, no specific predictions were made.

Methods

Participants

Fifty-six volunteers participated in the current longitudinal training study (*M* = 114 months; range = 108-125 months; 30 girls, 26 boys) at T1 (UK Year 5). One child dropped out of the study before T3 from the AE condition. Participants were divided into three conditions (AE training, SB training and a WL control group) matched for age, listening comprehension (the Neale Analysis of Reading Ability-R; NARA-II) and word-reading ability (the Gates-MacGinite Vocabulary Test; GM). See Table 1 for participant characteristics for all three conditions. The children came from a primary school in the south of England. The sample was unselected but excluded children whose first language was not English or who were diagnosed with a specific learning disability (e.g., dyslexia). In addition, children who performed 1.5 SDs or more below the year-group mean (derived from 122 children in Year 5 from the same school) on the Gates-MacGinite Vocabulary Test (Level 3), an indication of word reading ability (*GM* < 28 out of 45), were excluded to ensure children would be able to perform the reading task. For the 56 children who participated in the study, written consent was obtained from a

parent or guardian in accordance with the ethics procedure set out by the University Research Ethics Committee. Additionally, each child was informed that they could stop and leave at any point during the study.

Table 1

Participant Characteristics one month before T1

	Active Experience Training		Storyboard Construction Training		Waitlist Control			
	N = 20		*N* =19		*N* = 17			
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(2,33)	*p*
Age (Months)	112.36	3.39	113.85	3.56	114.31	4.29	0.07	.929
NARA-II	18.50	4.57	18.79	4.43	19.06	4.52	0.07	.932
G-M	39.10	3.54	39.00	4.24	38.88	3.66	0.02	.985

Materials

Group Assessments. The Neale Analysis of Reading Ability- R (NARA-II), a reading comprehension assessment modified for use as a listening comprehension test, was used for the group comprehension assessment (Neale, 1997). Teachers alternated between administering equivalent Forms 2 (September and June) and Form 1 (February). Only the scores from the NARA-II version administered at the beginning of the academic year were used in the current study. Both versions of the NARA-II have the same practice story, which was read out loud as an example, and six test stories (Levels 1-6) in total. For the current study, children were read stories from Level 2 onwards, the suggested starting point for children 8 to 9-years-old (Neale, 1997). Children were given an answer booklet with 8 comprehension questions per story (including the practice story) in which they had to write their answers individually.

Three different versions of the Gates-MacGinite Vocabulary Test (G-M) were used to measure children's word-reading ability (September: Level 3: standardised for US children in the 3rd grade), Form K; February and June: Level 4 (standardised for US children in the 4th grade), Forms T and S (MacGinite et al., 2000). Like the NARA-II, only the scores from the GM version administered at the beginning of the academic year are reported here. The G-M is a multiple choice, pen and paper task. At Level 3, there were 4 examples that children worked through with their teacher and 45 test questions that children worked through on their own. At Level 4, there were two examples children worked through with their teachers and the same number of test questions. For each question, children had to decide which word or phrase out of a choice of four (e.g., "clean", "at the store", "first" and "near") matched with a word or phrase (e.g., "they are close").

Individual Session. At the beginning of each individual session, children were administered a questionnaire inspired by the Vividness of Visual Imagery Questionnaire (Marks, 1973), but instead of focusing on visual imagery, this new questionnaire asked readers to describe the vividness of their mental images (including whether there was movement and sounds), after reading short excerpts from a five-sentence narrative, originally, found in the NARA-II (Form 1). Data from this questionnaire are not reported in this paper, because, instead, its focus is on the benefits of strategies on comprehension, rather than the relationship between mental imagery, the strategies and comprehension. Six short stories were written for the test sessions, which were each between 246-250 words long. Three of the short stories took place in a fish tank and the other three took place in a child's bedroom (see Appendix VI for an example test story and corresponding comprehension questions). The test stories were written to permit the assessment of children's understanding of literal and inferential emotional and spatial

information. Two raters independently divided the stories into idea units and discussed any discrepancies, Kappa = .98, $p < .001$. Four additional short stories (117-135 words), which all took place in a family's back garden, were written for training purposes. Storyboards consisted of a colourful, laminated background scene (10 x 12 inches) that represented the setting of a story: a fish tank, a child's bedroom or a family's back garden (See Appendix II for storyboards and cut-outs). Each storyboard also had two (for practice stories) or six (for test stories) laminated cut-outs (between 2-3 inches tall) that corresponded to characters or objects found in the text. A digital voice recorder was used to record children's responses.

Design

There were four independent variables: condition (three levels: Storyboard Construction, Active Experiencing and Waitlist-Control), time point (three levels: T1 (October), T2 (February) and T3 (June)), question content (two levels: emotional and spatial) and question type (two levels: literal and inferential). For the F1 by-subject analyses, condition was a between-subjects variable, and time-point, question content and question type were repeated-measures variables. For the F2 by-items analyses, condition and time-point were repeated-measures variables and question content and question type were between-items variables. There were two dependent variables: number of comprehension questions correct and proportion of idea units recalled in a free recall task, which took place before the comprehension phase. The number of idea units recalled was converted to proportions for purposes of analysis, because the test stories had different numbers of idea units.

Procedure

Group Assessments. All students in Year 5 were administered the NARA-II and G-M at the beginning of the academic year (September, 2014; one month before the

first individual training/testing session) and then again in February and June, 215 (around one week before the corresponding individual sessions). Teachers administered the assessments to their entire class.

T1. Fifty-six children who met the inclusion criteria and provided parental consent were included in the main study. All individual and group training took place in the Year 5 group room. During the first individual training/test session participants were asked to fill out the vividness of mental imagery questionnaire. Participants were quasi-randomly allocated to one of three conditions and were matched on NARA-II and GM scores. Before reading the two test stories, children in the AE and SB conditions were taught how to use their corresponding reading strategies. During their individual training session, participants in both groups were told what the strategy entailed and were then read a short story[7] by the experimenter while she demonstrated the strategy. For the AE condition, participants were told they would be taught how to act out what they were reading using emotional expression and movements (e.g., gestures). Then the experimenter read a short story while enacting the protagonist's facial expressions and hand gestures, and using appropriate vocal inflection. For the SB condition, participants were told they would be taught how to create a storyboard, which involves placing cut-outs on a background that match up with what is going on in the story. The experimenter then read a short story out loud while placing cut-outs on a colourful background scene that corresponded to actions in the story. Then, participants in the AE and SB conditions were asked to read the story out loud to the experimenter while using the strategy appropriate to the condition.

[7] The same short story was used for all individual training sessions.

During the test session, children in the AE and SB conditions read two more short stories (one fish tank and one bedroom story[8]) using the activity they had just been taught. They were encouraged to use the activity in a way they thought would help them understand the story. Participants read each short story out loud twice. First, without the strategy ("how you would normally"), in order to familiarise themselves with the text, and then again using the strategy. Before being asked to read the story again, children in the SB condition were given a corresponding storyboard with its cut-outs scattered to the side of the board. The experimenter took a picture of participants' completed storyboard to measure its veracity. Children in the WL condition were also asked to read two short stories, also through twice, as they would normally. After children had read each test story through twice, the experimenter talked to them about what they liked to read and school in general for two minutes as a distractor task. Afterwards, the children were asked first to recall the story out loud and then to answer eight comprehension questions out loud (two literal and two inferential, emotion comprehension questions; and two literal and two inferential, spatial comprehension questions), which the experimenter read out loud to them. Their responses were recorded.

Group Training between T1 and T2. Once a month between the first and second individual training/test sessions (three times), the experimenter worked with groups of 6-8 participants to remind them about the strategies they were being encouraged to use. For children in the AE and SB conditions, the experimenter first demonstrated the strategy to the entire group while reading the original training story out loud as a reminder. Then, the experimenter read a new story to the group to

[8] Each of the three bedroom stories was paired with one of the three fish tank stories. Participants were allocated a new story pairing for each test session but always read either the fish tank or bedroom story first.

familiarise them with the story. The "new story" was different for each subsequent group session but all stories took place in a child's back garden. Afterwards, children were put into pairs (one storyboard to a pair for children in the SB condition) and asked, one at a time, to read the story out loud to their partner using the strategy. Afterwards children were told that they could use the strategy while reading on their own. Children in the AE condition were encouraged to try using different voices and movements (i.e., hand movements) to act out what they are reading and if they are reading silently, to try creating different voices in their head. Children in the SB condition were encouraged to try creating a storyboard of what they were reading in their head. To standardise time spent with each group, the experimenter also met with children in the WL condition (groups of 6-8) every month for the same amount of time and read them a short fable by Aesop. After reading the fable, the experimenter asked each participant to describe what he or she liked about the story.

T2. At the beginning of the second individual training/test session, children were asked to fill out a second vividness of mental imagery questionnaire. Because SB training improved children's recall to a greater extent than AE, children in the WL condition were trained to use SB, using the same procedure as the SB condition for T1. Before reading two test stories, children in the AE and SB conditions were asked to imagine using their corresponding reading strategies, while reading the practice story to themselves. Children in the AE condition were instructed to imagine using different voices and movements to act out the story in their head. After reading each section, children were encouraged to stop and imagine how they would act out the story. The children in the SB condition were instructed to imagine constructing a storyboard. After reading each section, the children were encouraged to stop and imagine how their storyboard looked or had changed. At the end, the experimenter asked participants to

describe what was going on in their heads while they were reading to make sure they were using the strategy. Before the test session, children in the AE and SB conditions were instructed to practise using the original strategy they were taught in October as a reminder.

For the WL condition, T2 was identical to the first SB test session. For the AE and SB conditions, while reading the two test stories twice through, children were encouraged to imagine using the corresponding strategy. Again, participants were encouraged to use the strategy in a way they thought would help them understand the story. For the first reading, children were asked to imagine using their respective strategy while reading the story out loud. They were then asked to describe what was going on in their head (the story was removed so participants could not refer to the stories). For the second reading, children in the AE and SB conditions were asked to read the story to themselves while imagining using the strategy.

Group Training between T2 and T3. Group training for the WL condition followed the same protocol as the SB training between the first and second individual sessions. Children in the SB and AE conditions did not receive any training.

T3. The training and test sessions for AE and SB were exactly the same as at T2. For the WL condition, T3 was the same as T2 and T3 for the SB condition.

Scoring.

Neale Analysis of Reading Ability II. The experimenter graded the listening comprehension assessment by comparing children's written answers to a list of acceptable answers. Children could earn up to one point per question (.5 points were also awarded for relevant partial answers). Raw scores were used in the analyses.

Gates-MacGinite. For the word reading assessment, children were assigned one point for every question they answered correctly. There were 45 items in total.

Recall. The audio recordings were transcribed. All of the transcripts were scored by one rater, but to make sure the coding was reliable, a second rater scored 10% of the transcripts for all test sessions, Kappas = .94 - .97, *ps* < .001. All raters scored children's recall by comparing recall transcripts to a list of idea units from the story. Children received one point for every idea unit they recalled correctly. Correct idea units did not need to be recalled verbatim or in the correct order but they did need to be in reference to the same section of the story. Half points were awarded for partially-recalled idea units.

Comprehension. Comprehension responses were scored using an answer key generated by the experimenter. Children could earn up to one point per answer (.5 points were awarded for relevant partial answers). There were eight comprehension questions per story (two literal and two inferential, emotion comprehension questions; and two literal and two inferential, spatial comprehension questions). Comprehension performance was scored by one rater, but a second rater scored 10% of responses for all test sessions, Kappas = 1.00, *ps* < .001.

Results

The results will be presented in three sections. The first section lays out the short-term benefits of AE and SB training (versus WL controls), the second section presents the long-term changes in performance as a function of training condition (AE and SB conditions only) and the final section presents the effects of SB training for children in the waitlist control condition. In keeping with the study design, this group received SB training at T2 because results at T1 indicated better outcomes for SB than AE training. Table 2 includes a summary of the descriptive statistics for all three conditions during all three sessions.

Table 2

Recall and comprehension performance as a function of condition

	Active Experience Training		Storyboard Construction Training		Waitlist Control	
Measure (total)	*M*	*SD*	*M*	*SD*	*M*	*SD*
Session 1 (T1)						
Recall (percentage correct)	30.39	12.46	38.76	13.77	26.69	12.52
Emotion literal questions (4)	3.68	0.48	3.47	0.63	3.12	0.70
Emotion inferential questions (4)	2.76	0.95	2.53	0.84	2.53	0.94
Spatial literal questions (4)	2.84	0.76	3.39	0.16	2.65	0.93
Spatial inferential questions (4)	1.97	0.84	2.66	0.76	1.85	0.82
Total questions (16)	11.35	2.03	12.05	1.43	10.15	1.98
Session 2 (T2)						
Recall (percentage correct)	33.34	15.23	38.16	14.83	42.53	16.13
Emotion literal questions (4)	3.45	0.40	3.18	0.63	3.29	0.69
Emotion inferential questions (4)	2.79	1.05	2.76	1.21	2.76	1.10
Spatial literal questions (4)	2.76	0.89	3.16	0.74	3.71	0.40
Spatial inferential questions (4)	2.05	1.13	1.18	0.93	3.03	0.99
Total questions (16)	11.08	2.28	10.92	2.05	12.82	1.83
Session 3 (T3)						
Recall (percentage correct)	34.74	14.88	38.66	12.82	39.76	12.44
Emotion literal questions (4)	3.21	0.58	3.29	0.58	3.35	0.58
Emotion inferential questions (4)	3.11	0.79	3.11	0.66	2.82	0.77
Spatial literal questions (4)	3.08	0.93	2.76	0.71	2.88	0.91
Spatial inferential questions (4)	2.08	1.20	2.00	0.91	1.91	0.99
Total questions (16)	11.47	2.21	11.16	1.68	10.97	1.67

1. The short-term benefits of AE and SB training

a. Does AE and SB training improve recall? It was predicted that, based on past research, children in both the AE and SB conditions would have improved memory for narrative stories compared to children in the WL condition (Berenhaus et al., 2015; Rubman & Waters, 2000). The one-way between-subjects (condition: AE, SB and WL) ANOVA revealed a significant main effect of condition, F (2,53) = 4.38, p = .017, η_p^2 = .142. Pairwise comparisons (Bonferroni corrected) revealed that, as predicted, children in the SB condition recalled a higher percentage of idea units than children in the WL

condition, $p = .020$, but not the AE condition, $p = .106$, *ns*, (refer to Table 2 for means and SDs). Contrary to predictions, there was no difference in performance between the AE and WL conditions, $p = 1.00$, *ns*. Thus, SB but not AE training improved children's memory for short stories compared to controls.

b. **Does AE improve emotion comprehension and SB, spatial comprehension?**

It was predicted that AE training would improve children's literal and inferential comprehension of emotional information and that SB training would improve children's literal and inferential comprehension of spatial information, both compared to children in the other conditions. Mixed 3(condition: AE, SB and WL) x 2(question-content: emotional and spatial) x 2(question-type: literal and inferential) ANOVAs (F1 and F2 analyses were used in all subsequent comprehension analyses) revealed that children performed better on emotional than spatial questions, $F_1(1, 53) = 17.55$, $p < .001$, $\eta_p^2 = .249$, $F_2(1, 99) = 4.76$, $p = .035$, $\eta_p^2 = .098$, and on literal than inferential questions, $F_1(1, 53) = 67.27$, $p < .001$, $\eta_p^2 = .559$, $F_2(1, 88) = 14.08$, $p = .001$, $\eta_p^2 = .242$. There was also a main effect of condition, $F_1(2, 53) = 4.93$, $p = .011$, $\eta_p^2 = .157$, $F_2(2,88) = 6.43$, $p = .002$, $\eta_p^2 = .128$. Pairwise comparisons (Bonferroni corrected) revealed that overall, children in the SB group performed better than WL on comprehension questions, $ps < .009$. Thus, at baseline, participants performed better on literal than inferential and on emotional than spatial questions and that overall (irrespective of question content or type), participants who received SB training performed better than controls on comprehension questions.

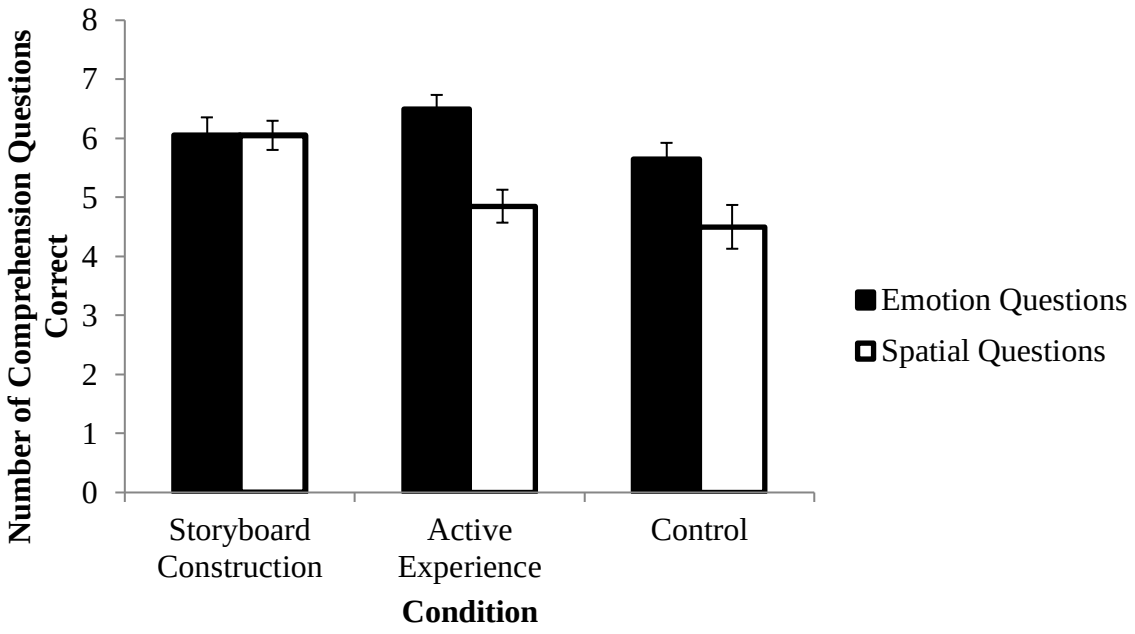

Figure 1. The number of comprehension questions correct (maximum correct: 8) as a function of condition and question content (+/- SEM).

The main effects of question content and condition were both qualified by a condition x question content interaction (shown in Figure 1), $F_1(2, 53) = 5.51$, $p = .006$, $\eta_p^2 = .173$, $F_2(1, 88) = 4.37$, $p = .042$, $\eta_p^2 = .090$. To test specific predictions, t-tests were conducted comparing AE versus WLs and AE versus SB on emotional questions (Bonferroni corrected significance threshold: .025) and SB versus WL controls and SB versus AE on spatial questions (Bonferroni corrected significance threshold: .025). As predicted, children in the AE condition performed better than WLs on emotional questions, $t_1(35) = 2.38$, $p = .023$, $t_2(23) = 2.64$, $p = .015$, but contrary to predictions, there was no significant difference between the AE and SB conditions on emotional questions, $t_1(37) = 1.34$, $p = .188$, *ns*, $t_2(23) = 1.47$, $p = .165$, *ns*. In addition, as predicted, children in the SB condition performed better on spatial questions than WLs, $t_1(35) = 3.52$, $p = .001$, $t_2(23) = 3.57$, $p = .002$, and children in the AE condition, $t_1(37) = 3.18$, $p = .003$, $t_2(23) = 2.68$, $p = .013$. Thus, AE training improved children's performance on emotional questions compared to controls, but not compared to children

who received SB training. In contrast, SB training improved children's performance on spatial questions compared to both controls and children who received AE training.

2. **The long-term benefits of AE and SB training**

Although previous research has explored the benefits of encouraging readers to imagine using manipulation strategies on children's memory for stories, no specific predictions were made for the long-term benefits of AE and SB training, because of the novelty of the study design (Glenberg et al., 2004; Marley & Szabo, 2010).

a. Do children in the strategy conditions maintain the benefits of AE and SB on recall? A 3(time: T1 – T3) x 2(condition: SB and AE) mixed design ANOVA revealed no main effect of time, condition or a time x condition interaction, *ps* >.146, *ns*. The fact that the performance of children in the SB condition did not decline over time (i.e., no decline in performance during T2 versus T1 and T3 versus T1) suggests they may have maintained the benefits of SB on recall during the follow-up sessions. This conclusion is difficult to make without a comparison group.

b**. Do children in the strategy conditions maintain the benefits on comprehension?** Mixed 3(time: T1 – T3) x 2(condition: AE and SB) x 2(question-content: emotional and spatial) x 2(question-type: literal and inferential) ANOVAs revealed participants performed better on emotional than spatial questions, $F_1(1, 36) = 62.42$, $p < .001$, $\eta_p^2 = .634$, $F_2(1, 44) = 7.29$, $p = .010$, $\eta_p^2 = .142$, and on literal than inferential questions, $F_1(1,36) = 79.62$, $p < .001$, $\eta_p^2 = 689$, $F_2(1,44) = 12.70$, $p = .001$, $\eta_p^2 = .224$, like in Section 1 Part B. Thus, at baseline, it appears participants performed better on emotional than spatial and on literal than inferential questions. The analyses also revealed a main effect of time, by-items only, $F_1(2, 72) = 1.07$, $p = .348$, *ns*, $\eta_p^2 = .029$, $F_2(2,88) = 3.19$, $p = .046$, $\eta_p^2 = .068$. Specifically, pairwise comparisons (Bonferroni corrected) revealed that children in the AE and SB conditions performed

better during T1 than T2, by-items only, p_1 = .446, *ns*, p_2 = .014. No other comparisons were significant, *ps* > 417, *ns*. Thus, overall, participants in the original training conditions performed better during T1, immediately after strategy training than T2, three months later.

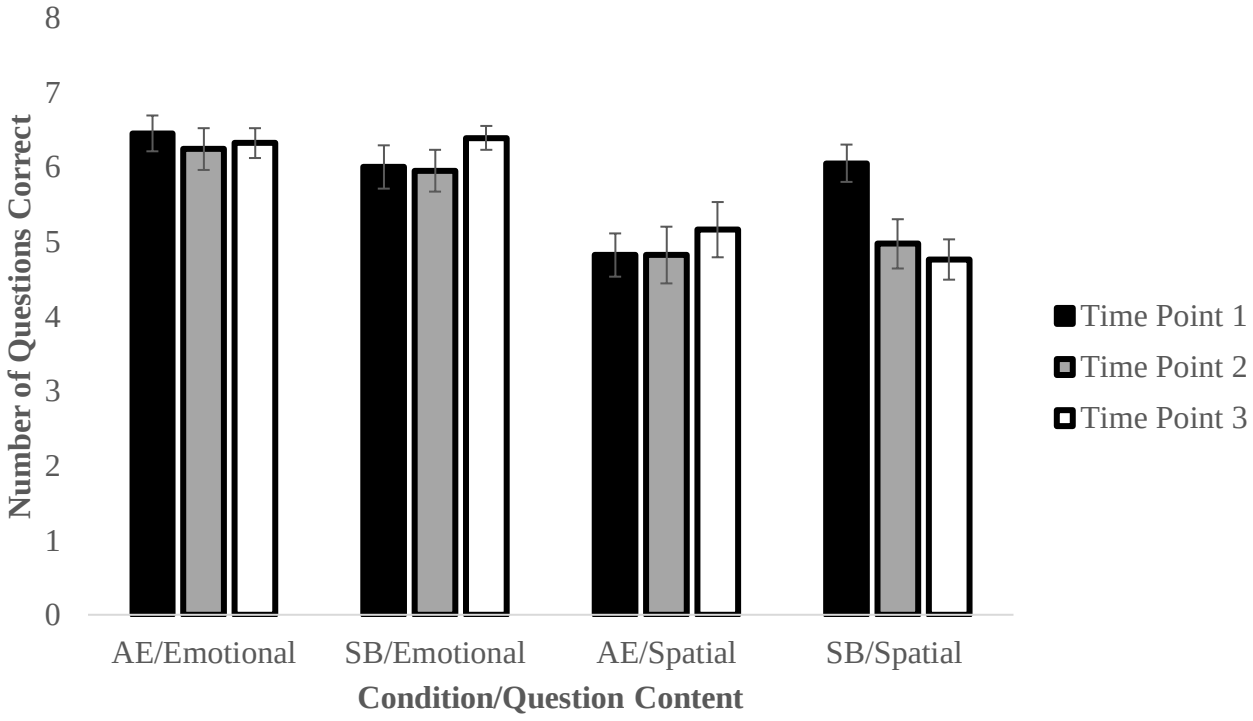

Figure 2. The number of comprehension questions correct (maximum correct: 8) as a function of time, condition and question content for children in the AE and SB conditions (+/- 1 SEM).

The main effects of time and question content were both qualified by a time x condition x question content interaction, $F_1(2, 72) = 5.09$, $p = .009$, $\eta_p^2 = .124$, $F_2(2,88) = 4.03$, $p = .021$, $\eta_p^2 = .084$ (see Figure 2). To explore the 3-way interaction, 3(time: three time points) x 2(question-content: emotional and spatial) ANOVAs were conducted for each condition, separately. For the AE condition, overall, participants performed better on emotional than spatial questions, $F_1(1,18) = 44.05$, $p < .001$, $\eta_p^2 = .710$, $F(1,46) = 7.28$, $p = .010$, $\eta_p^2 = .137$, but there was no main effect of time, *p*s > .343, *ns*, nor a time x question content interaction, *ps* > .554, *ns*. The fact that children

in the AE condition's performance on emotional questions did not decline over time suggests they may have maintained the benefits of AE on emotional comprehension questions but this interpretation is difficult to substantiate without a comparison group. For the SB condition, overall, there was no main effect of time, *ps* > .097, *ns*, and participants performed better on emotional than spatial questions by-ss only, $F_1(1,18) = 19.73$, $p < .001$, $\eta_p^2 = .523$, $F_2(1, 46) = 3.43$, $p = .070$, *ns*, $\eta_p^2 = .069.057$, *ns*, which were both qualified by a significant time x question content interaction, $F_1(2, 36) = 5.27$, $p = .010$, $\eta_p^2 = .227$, $F_2(2, 92) = 4.89$, $p = .010$, $\eta_p^2 = .096$ (see Figure 2).

To unpack the two-way interaction, two one-way (time: three levels) ANOVAS were conducted for emotional and spatial questions. There was no main effect of time for emotional questions, *ps* > .216, but there was for spatial questions, $F_1(2, 36) = 5.94$, $p = .006$, $\eta_p^2 = .248$, $F_2(2, 46) = 5.07$, $p = .010$, $\eta_p^2 = .181$. Specifically, children in the SB group performed better during T1, immediately after they received their training, than T2, *ps* < .046, after three months of top-up training, and T3, *ps* < .015. There was no difference in performance between T2 and T3, *ps* = 1.00, *ns*. It is important to remind the reader that between T1 and T2, children received monthly, group top-up training and that during both T2 and T3, children were given the opportunity to practice imagining constructing a storyboard. Thus, children in the SB group were unable to maintain the benefits of SB training on spatial comprehension questions even with three months of monthly top-up training and having the opportunity to practice imagining using the strategy.

3. The effects of SB training for WLs

a. Do children in the WL condition have improved recall immediately after SB training compared to three months earlier? Do they maintain those benefits three months later? It was predicted that SB training would have an immediate,

positive effect on children's memory for narrative texts. Thus, we would expect that children in the WL condition would have improved recall of narrative texts immediately after SB training (T2) compared to before training (T1). A within-subject (time: three levels) ANOVA revealed a main effect of time, $F(2,32) = 25.20$, $p < .001$, $\eta_p^2 = .612$. Pairwise comparisons (Bonferroni corrected) revealed that children recalled a higher percentage of idea units during T2 than T1, $p < .001$. Children also recalled a higher percentage of idea units during T3 than T1, $p < .001$. In addition, children maintained their performance from T2 to T3, $p = .979$. Thus, children in the WL condition, who received SB training during T2, monthly group, top-up training in between T2 and T3 and practiced imagining using SB during T3, showed an improvement in their memory for stories during T2 compared to T1 and appeared to maintain that improvement based on the significant difference between T3 and T1 and the absence of a difference between T2 and T3.

b. Do children in the WL condition have improved comprehension immediately after SB training compared to three months earlier? Do they maintain those benefits three months later? It was predicted that SB training would have an immediate, positive effect on children's comprehension of literal and inferential spatial information in the stories they read. Thus, we would expect that children in the WL condition would have improved performance on literal and inferential spatial comprehension questions immediately after SB training (T2) compared to before training (T1). 3(time: three time points) x 2(question-content: emotional and spatial) x 2(question-type: literal and inferential) mixed-design ANOVAs revealed children performed better on literal than inferential questions, $F_1(1,16) = 29.30$, $p < .001$, $\eta_p^2 = .647$, $F_2(1, 44) = 10.48$, $p = .002$, *ns*, $\eta_p^2 = .192$, and on emotional than spatial questions, by-ss only, $F_1(1,16) = 4.75$, $p = .045$, $\eta_p^2 = .229$, $F_2(1, 44) = 2.11$, $p = .153$, *ns*, $\eta_p^2 =$

.046. In addition, there was a main effect of time, $F_1(2,32) = 12.50$, $p < .001$, $\eta_p^2 = .439$, $F_2(2,92) = 13.45$, $p < .001$, $\eta_p^2 = .226$. Pairwise comparisons (Bonferroni corrected) revealed that participants performed better during T2 than T1 (*ps* < .001) and T3 (*ps* < .028). There was no difference between T1 and T3 (*ps* > .138). Thus, irrespective of question content or type, children in the WL condition performed better during T2 than T1, but did not maintain the benefits during T3.

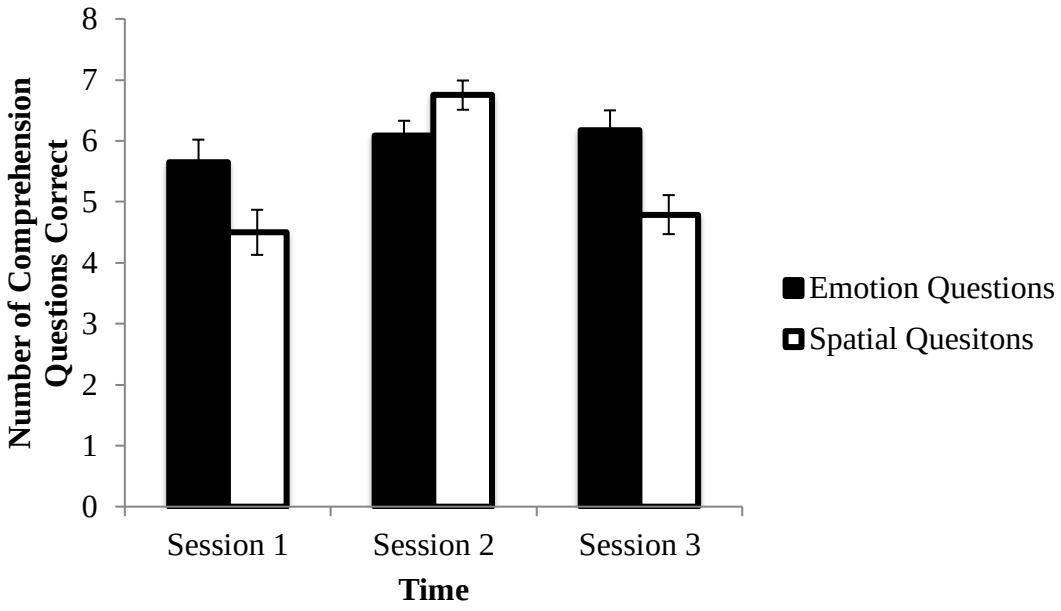

Figure 3. The number of comprehension questions correct (Maximum Correct: 8) as a function of time and question content for children in the WL condition (+/- SEM).

The main effect of time and question content were qualified by a significant time x question content interaction (Figure 4), $F_1(2, 32) = 9.79$, $p < .001$, $\eta_p^2 = .380$, $F_2(2, 88) = 10.86$, $p < .001$, $\eta_p^2 = .198$. To explore the interaction and determine whether participants in the WL condition benefited from SB training (T2), compared to before training (T1) and whether participants maintained any benefits three months after training (T3), t-tests (T2 versus T1 and T3 versus T1; Bonferroni corrected significance threshold: .025) were conducted for children's performance on emotional and spatial questions, separately.

For emotional questions, Figure 4 suggests that children may have performed slightly better during T2 and T3 than T1, which was not supported by the t-tests, T2 versus T1, *ps* > .342, T3 versus T1, *ps* >.061, *ns.* Thus, SB training did not improve children's performance on emotional questions compared to before training. For spatial questions, as predicted, children performed better during T2 than T1, $t_1(16) = 6.36$, $p < .001$, $t_2(23) = 5.45$, $p < .001$. There was no difference in performance between T3 and T1, $p > .33$, *ns*, which suggests participants did not maintain the benefits of SB training on spatial comprehension. To confirm participants in the WL condition did not maintain the benefits of SB training three months later, an additional t-test (T2 vs T3) was conducted, which found that children performed better during T2 than T3, *ps* < .001, and thus, did indeed not maintain the benefits of SB. Thus, the time x content interaction was a result of SB training improving children's performance on spatial, but not emotional questions. later.

Discussion

The current study aimed to investigate the short-term benefits of active experience and storyboard construction training on children's memory for short, narrative stories as well as their performance on emotion-based and spatial-based literal and inferential questions. In addition, the current study also aimed to explore the potential, long-term benefits of AE and SB training on children's memory and comprehension with the aid of three monthly, top-up group training sessions and encouraging children to imagine using the strategies. As predicted, children who used SB had improved recall and performance on spatial-based questions (literal and inferential) immediately after training compared to other conditions (SB condition) and compared to before training (WL condition). Contrary to predictions, there was no benefit of AE training on children's memory for narrative texts.

In addition, children who received SB training (during T1 for children in the SB condition and during T2 for children in the WL condition) maintained the benefits on recall at least three months after training (T2 for the SB condition and T3 for the WL condition) and possibly three months after that, as well (T3 for the SB condition). Children's performance on spatial comprehension questions returned back to pre-training levels during T2 and T3 (SB condition; T3 only for the WL condition). In terms of the benefits of AE training, children in the AE condition performed better on emotion-based questions immediately after training than controls, but contrary to predictions, not better than children in the SB condition. The benefits of AE on emotion comprehension were possibly maintained three and six months later. One particularly surprising finding was that three (for the WL condition) and six months (for the SB condition) after training, children who received SB training showed improved performance on emotion questions overall (for the WL condition) or emotion inference questions only (for the SB condition) compared to T1. It is important to remember that T1 for the WL condition was three months *before* training while T1 for the SB condition was *immediately after* training.

In the following section, we will discuss the significance and limitations of the results in the contexts of children's education, previous research and directions for future research. The immediate benefits of SB training compared to controls (for the SB condition) and compared to before training (for the WL condition) on recall supports previous research that has demonstrated that manipulating cut-outs or playset pieces to act out the content of a story improves children's memory for that story (Berenhaus, Oakhill, & Rusted, 2015; Glenberg et al., 2004; Marley, Levin, & Glenberg, 2007; Marley & Szabo, 2010; Rubman & Waters, 2000). In contrast to Glenberg and colleagues (2004) and Marley and Szabo (2010), the current study demonstrated that

children may only require a short practice session, as opposed to more structured training, in order to experience the benefits of a manipulation strategy on, for example, story recall. Furthermore, this study extends previous research on the benefits of physicalisation strategies for improving children's reading comprehension, in support of the theory of embodied cognition (Barsalou, 2008b; De Koning & van der Schoot, 2013a; Glenberg, 2011). For example, this is the first study to demonstrate that a manipulation strategy (e.g., SB) improves children's performance on spatial comprehension questions, and that an enactment strategy (e.g., AE) improves their performance on emotional comprehension questions. In terms of the immediate benefits of SB training on spatial comprehension (literal and inferential), this is the first study to demonstrate the benefits of manipulation strategies on children's ability to integrate spatial information *within* a text. In contrast, previous studies have demonstrated their benefits on children's ability to integrate information from a visual representation of the story's setting (e.g., a playset) with information in the text (Glenberg et al., 2004). Although learning to integrate content from different modalities is important for learning to comprehend multimodal content (eg graphic novels, movies), being able to integrate different segments within a text, is necessary for successful *reading* comprehension – a skill that is essential for reading novels and learning in school to adulthood. The combined benefit of SB training on children's memory and comprehension of text is especially interesting because it suggests that SB while reading *specifically* helps children construct a coherent mental model from text only.

In a similar vein, the immediate and long-term benefits of SB and AE training demonstrated in the current study support an embodied (or at least grounded by interaction) approach to mental model construction (Mahon & Caramazza, 2008). Specifically, the benefits of encouraging children to use a strategy that provides them

with content-relevant sensorimotor experiences suggests that constructing a coherent mental model of a text may require (or at least benefit from) visual-spatial and motoric traces that simulate the content of the story (Mahon & Caramazza, 2008). In addition, the current study was the first of its kind to demonstrate the short (pre versus post-training; SB only) and long-term benefits (SB and AE) of either of these strategies for the same set of students. Thus, these findings strengthen the support for the immediate and long-term benefits of physical strategies on children's memory for and comprehension of narrative texts. In terms of the WL condition, specifically - the results from which, provided the most compelling within-participant evidence - the within-subject comparison (T3 versus T1) successfully demonstrated that children maintained the advantages they achieved immediately after training (T2 versus T1) on recall but that their performance on spatial-based comprehension questions returned to pre-training levels. In terms of the long-term benefits of both strategies more generally, there were no specific predictions because no previous study has looked at the long-term benefits (ie after 2+ months of training) of AE and SB training on story recall and narrative comprehension. Although previous studies have demonstrated that manipulation strategies can be internalised (i.e., used as an imagery strategy), this is the first study of its kind to demonstrate whether those strategies' benefits could be maintained three and six months after the original training session (Glenberg et al., 2004; Marley & Szabo, 2010).

One unexpected finding that came out of the current study was the delayed benefit of storyboard construction on children's performance on literal and inferential emotion-based comprehension question (T3 versus T1 - WL condition). As a reminder, the current study predicted that AE training would immediately improve children's comprehension of emotion-based comprehension questions compared to controls and

children in the SB condition. Instead, AE training only improved children's emotion-based comprehension compared to controls. Interestingly, as a predictor of the long-term benefits of SB training on emotion-based comprehension, during T1, Figure 1 suggested that SB training improved children's comprehension overall rather than only on spatial-based comprehension questions. This was supported by the main effect of condition on comprehension performance; specifically, children in the SB condition had better comprehension overall than children in the control condition (although children in the SB condition's performance on emotion comprehension questions, specifically, was not better than controls). In terms of why storyboard construction training would improve children's performance on emotion-based comprehension questions, even though the strategy encouraged children to create a *spatial* representation of what they were reading, perhaps giving children a strategy to apply mental images to their mental models decreased their cognitive load, thus, giving children the opportunity to focus on other elements of the story (e.g., the protagonist's emotional state).

The current study's lack of evidence for the immediate benefits of AE on recall compared to controls *appeared* to contrast with previous research that demonstrated the benefits of AE and enactment on recall. Interestingly, while Berenhaus et al. (2015) found that AE improved children's memory for descriptive information in short stories compared to controls, similar to the present study, they also found no difference between conditions on children's recall of the *entire* story. Together, these findings suggest that the AE strategy may have contributed a more specific benefit to recall that the current recall measure could not detect. This interpretation was supported by the current study's comprehension results. Specifically, in terms of the immediate benefit of AE and SB on comprehension, as predicted, during T1, children in the AE condition performed better on emotion comprehension questions (both literal and inferential

questions) than children in the WL, but not the SB condition. Specifically, children's performance on emotion literal questions is indicative of their memory for emotion-based information in a story, while their performance on emotion inference questions is indicative of their ability to integrate emotion-based inferences into their mental model. Thus, perhaps AE only improves children's memory and comprehension of strategy-relevant content (i.e., the character's emotional state).

The current study's AE results contrasted with previous research focused on the benefits of gesture, specifically enactment, on children's memory and comprehension of narrative texts (Cutica, 2014). Specifically, children who only used gesture to act out an expository text have previously been found to have improved recall and coherence of recall compared to readers who read as they would normally. Cutica (2014) argued that this difference demonstrated the benefits of using gestures to enact a text. The current study did not specifically encourage children to use gesture, but rather, any type of voice and movement (e.g., hand movements) that would help them act out what was going on in the story. When the experimenter demonstrated the strategy to participants, she used gesture, but never explicitly told participants to do the same. The possibility that AE would be more beneficial if children were specifically encouraged to gesture and/or use other body movements, in addition to emotional expression, was supported by one of the first studies to provide evidence for the theory of Active Experiencing (Noice & Noice, 2001). Specifically, Noice and Noice (2001) explored the benefits of AE on memory by asking undergraduates to memorise their part in a scene (1) by fully embodying the character they were playing and using any emotional expression and movement to act out the scene (full-AE), (2) by getting emotionally and cognitively involved in the scene and using emotional expression only to act out the scene (partial-AE), or (3) by focusing on memorising their part (control). Participants in the full-AE

condition remembered more of their lines than participants in the partial-AE or control conditions, suggesting that physical movements specifically benefits participants' reading comprehension.

It is important to note that one significant limitation of the current study was a lack of a between-subject control condition during T2 and T3. Thus, based on the current study's results alone, it would be difficult to conclude with certainty that the longitudinal results were a function of training/maintaining the benefits of training as opposed to time spent in the Year 5 classroom. Thus, perhaps in a future study, children in the control condition could remain in the control condition for the duration of the study. For the benefit of developing the most beneficial strategy for improving children's comprehension of and memory for narrative texts, future research could explore whether gesture on its own would be as beneficial as gesture plus emotional expression for children's memory and comprehension of narrative texts (specifically, with a protagonist) compared to expository texts. The reason one would predict that full-AE (emotion + movement) would be more beneficial than movement on its own would be because encouraging children to use emotional expression potentially gives them the opportunity to empathise with characters in the text. Considering the overlapping benefits of active experiencing and storyboard construction and the fact that, at least in the context of the current study, SB training was more beneficial, perhaps future research could also investigate ways of combining SB and AE. For example, children could be encouraged to construct a storyboard while taking the perspective of the protagonist. Thus, children would be encouraged to mentalise and emotionally engage with the protagonist in addition to constructing a spatial representation of the text. One would predict that this would potentially be more beneficial than storyboard construction on its own, especially for poorer comprehenders

and other children who have difficulty empathising with others (i.e., children with autism). In conclusion, the current study demonstrated that comparing strategies found to improve children's ability to construct a mental model of a narrative text in slightly different ways could potentially benefit the development of new, innovative strategies that encourage children to simulate a story.

Declaration: Chapter 5

Prof. Jennifer Rusted (supervisor) and Prof. Jane Oakhill provided input on the study design, analyses and write-up for Experiment 1. Prof. Alan Garnham (supervisor) provided input on the study design for Experiments 2 and 3, all analyses and the write-up. Afifa Fatema (Undergraduate project student) took part in data collection for Chapter 5 (Experiment 3).

Chapter 5: An exploration of the effects of the perspective-taking prompts on narrative comprehension in both adults and children

Abstract

The current study explored the effects of perspective-taking prompts on reading comprehension and changes in arousal (i.e., an indication of emotional reactivity to narrative texts) as a function of reading. Experiment 1 compared the effects of asking young adults (1) to imagine themselves performing the actions of the protagonist, (2) to feel the emotions of the protagonist (to empathise) or (3) to read as they would normally on their literal and inferential comprehension of spatial and emotional information in narrative texts as well as their emotional arousal. Based on the positive effects of empathising with the protagonist on arousal, Experiment 2 compared the effects of asking young adults to empathise, sympathise (to care about how the protagonist is feeling) or read as they would normally on their literal and inferential comprehension of information about the protagonist and not about the protagonist. Information about the protagonist was further subdivided into emotional and non-emotional information. Sympathising with the protagonist improved readers' comprehension of literal emotional character information and inferential non-character information, whilst empathising with the protagonist negatively affected readers' performance on literal non-character information. To determine whether perspective-taking prompts could be useful in the classroom as a reading comprehension strategy, Experiment 3 replicated Experiment 2 with 9 to 10-year-old children. Experiment 3 found no effect of perspective-taking prompt on children's reading comprehension.

Introduction

In general, mental models are mental representations of a situation. A readers' mental model of a narrative text is assumed to be constructed from a particular point-of-view (Johnson-Laird, 1983). In addition, the dominant dimension, as discussed within a multidimensional framework (i.e., as discussed in the Event-Indexing model), is assumed to be the visuospatial dimension (Glenberg et al., 1987). This paper would like to argue, among other things, that these two assumptions may be hindering our ability to fully grasp the natural comprehension process (i.e., beyond traditional models). Specifically, other narrative dimensions, such as emotional information, may also play an important role in the comprehension process. In addition, very recent research suggests that the on-line perspective-taking process is more complicated than originally thought. For example, Hartung, Hagoort and Willems (2017) found that readers can be categorised into three categories of perspective-takers: Enactors (those that report experiencing the narrative as the protagonist), Observers (those that report experiencing the narrative as an eyewitness) and, most interestingly, Hypersimulators (those that report experiencing the narrative, simultaneously, as *both* the Enactor and Observer). Compellingly, as a measure of on-line comprehension, or at least engagement with the text, Hartung and colleagues (2017), found that self-reported perspective-taking preferences, rather than the perspective the text was written from, significantly predicted brain activity.

Recent research has found that the perspective a story is written from (Brunyé et al., 2011; Mulcahy & Gouldthorp, 2014) and the perspective a reader reports adopting while reading (Hartung, Hagoort & Willems, 2017) both impact narrative comprehension. In terms of the former, Brunye et al. (2011) found that adults performed better on spatial comprehension questions and were more aroused (e.g., lively, peppy

and active) after reading passages written in the 2nd person (i.e., the reader is considered the protagonist) compared to the 1st person (i.e., the reader is reading about an other's experience). The latter was considered an indication of readers' emotional reactivity to narrative events. Although perspective-taking often refers to the vantage point readers *visualise* a story from (Barnes, Raghubar, Faulkner & Denton, 2014; Ziegler & Acquah, 2013) readers can adopt the perspective of a character along multiple dimensions (Albrecht, O'Brien, Mason, & Myers, 1995; Zwaan, Langston & Graesser, 1995). Thus, the current study explored the effects perspective-taking along different dimensions (spatial and emotional) on readers' literal and inferential comprehension of narrative texts. Specifically, participants were asked to adopt the perspective of a story's protagonist emotionally (to feel what a character is feeling) or spatially (to simulate the actions and see what a character is seeing). Interestingly, in actual fact, whilst Experiment 1 compared the impact of emotionally-driven versus spatially-driven perspective-taking on readers' comprehension of emotional and spatial information, Experiments 2 and 3 evolved into only comparing two aspects of emotionally-driven perspective-taking: empathising versus sympathising (with the narrative's protagonist), on readers' comprehension of emotional and non-emotional information about the protagonist as well as non-character information. Emotional and spatial perspective-taking and comprehension were originally chosen to be compared in Experiment 1, because they were thought to be dissociable. The results of Experiment 1 instead suggest that their relationship is more complicated and that, in actuality, emotionally-driven perspective-taking more significantly impacts readers' experience. Whilst this element was not specifically explored, it is important to point out that mental models are also thought to be affected by a reader's personal relationship to the events described in the text (e.g., the reader will experience a text about a trapeze artist's experience more

vividly if the reader has actually been on a trapeze) (Zwaan, 2014).

Another factor explored between experiments is text-type. Specifically, literary texts versus narrative texts written for experimental purposes. They both have their benefits in an experimental context. For example, the former is more ecologically and gives readers the opportunity to become as emotionally engaged in a narrative text as they would at home. The latter, which varies in quality, considerably, across writers, allows the experimenter to measure specific elements of narrative comprehension more easily than previously written narrative texts (e.g., *Dubliners*).

Although no study has compared the benefits of two different dimensions of perspective-taking before, Gerald Cupchik, Keith Oatley and Peter Vorderer (1998) explored the effects of asking university students to imagine themselves as the protagonist or as a sympathetic spectator while reading excerpts from short stories from *Dubliners* by James Joyce (2013/1914), on their emotional experience while reading and subsequent memory for the text. Participants were asked to read excerpts from two short stories with emotional themes and two shorts stories that were descriptively dense. Regarding the effect of the perspective-taking prompt on participants' experience of the *Dubliners* excerpts (irrespective of passage type), participants who were encouraged to feel what a protagonist was feeling reported experiencing more fresh emotions, whilst participants who adopted the perspective of a sympathetic spectator experienced more emotional memories. Quality of passage was the only factor that affected participants' memory for the excerpts. Participants remembered more setting-oriented details from the emotional passages compared to the descriptive passages.

Rather than focusing on participants' memory for texts, the current study focused on measuring participants' literal and inferential comprehension of specific narrative dimensions, because the latter has been found to directly contribute to the

construction of a reader's mental model of a narrative (Cain & Oakhill, 2012). In addition, because changes in emotional affect are associated with the construction of multidimensional mental models of narrative texts, changes in feelings of arousal were also explored (Brunye et al., 2011). Using excerpts from *Dubliners*, Experiment 1 aimed to explore the effects of asking young adults (18 to 32-year-olds) (1) to imagine themselves performing the actions of the main character, seeing what the main character is seeing, (2) to imagine themselves as the main character, feeling what the main character is feeling (i.e., empathising) or (3) to read as they would normally, on their comprehension of literal and inferential emotional and spatial information in the texts. The effect of reading the excerpts on changes in feelings of arousal was also compared across conditions.

Experiment 2 aimed to extend the findings from Experiment 1 by asking participants to either emotionally adopt the perspective of a story's main character *or* of a spectator, rather than only the perspective of the main character. The prompts encouraged readers to either (1) empathise with the main character: feel what the main character is feeling, (2) sympathise with the main character: care about how the main character is feeling or to (3) read as they would normally. The perspective-taking prompts in Experiment 2 were only along the emotional dimension because empathising with the protagonist was found to have more of an impact on readers' experience than the action-simulation strategy. Rather than exploring the effects of the perspective-taking prompts on readers' comprehension of general emotional information, Experiment 2 tested participants' comprehension of more specific information in the texts, i.e., emotional information about the protagonist, non-emotional information about the protagonist and non-emotional information not about the protagonist. Because of the specificity of the comprehension questions, narrative stories were written for the

study, rather than using excerpts from *Dubliners*, as in Experiment 1. In order to determine whether the perspective-taking prompts from Experiment 2 could be applied to the classroom, Experiment 3 replicated Experiment 2 but with children (9 to 10-year-olds) as participants.

Experiment 1:

Young adults reading *Dubliners* from the perspective of the protagonist (simulating action versus empathising) or as they would normally

Predictions

1. **Comprehension:** Because simulation is thought to correlate with the ability to construct a coherent mental model (Zwaan, 2015), it was predicted that participants in the action-simulation condition would perform better on spatial comprehension questions than participants in the two other conditions and that participants in the empathic condition would perform better on emotional comprehension questions than participants in the two other conditions.
2. **Changes in feelings of arousal:** Based on previous research that found that adopting the perspective of a story's protagonist increased reader's arousal, it was predicted that participants in both the empathic and action-simulation conditions would report feeling more aroused after reading each excerpt compared to beforehand compared to the no prompt condition.

Methods

Participants

Sixty volunteers participated in Experiment 1 (*M* = 21 years old, *SD* = 3.09 years; *range* = 18 to 32; men = 23, women = 37). Participants were assigned to one of three perspective-taking conditions: action-simulation, empathic, or no prompt), which were matched on sex (there were 8 men and 12 women in each condition), age, reading comprehension ability, measured by the Nelson-Denny (ND), Verbal IQ, measured by

the National Adult Reading Test (NART) and interpersonal reactivity, measured by the Interpersonal Reactivity Index (IRI). The IRI includes 4 subscales that participants were matched on: Fantasy (the ability to transport yourself into fictional situations), Perspective-taking (the ability to flip perspectives in real life situations, i.e., to put yourself in someone else's shoes), Empathic Concern (to feel compassion/concern for another person), and Personal Distress (your discomfort/sadness at witnessing another's negative experience). See Table 1 for participant characteristics and one-way ANOVAs that demonstrate participants were matched on the various characteristics.

Table 1

Experiment 1 participant characteristics

	No prompt		Action-simulation perspective taking		Empathic perspective taking			
	$N = 20$		$N = 20$		$N = 20$			
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(2,57)	*p*
Age	20.75	2.97	20.65	1.79	21.60	4.13	0.56	.573
Reading Comprehension (ND)	31.05	5.49	31.65	4.30	31.60	4.90	0.09	.913
Verbal IQ (NART)	102.80	7.25	102.60	6.22	102.65	7.07	0.01	.995
IRI Scales:								
Fantasy Scale	3.85	0.63	3.80	0.67	3.65	0.54	0.68	.512
Perspective-Taking Scale	3.88	0.57	3.67	0.69	3.71	0.61	0.61	.550
Empathic Concern Scale	3.75	0.65	3.81	0.70	3.69	0.58	0.18	.837
Personal Distress Scale	2.54	0.74	2.69	0.63	2.73	0.60	0.47	.628

Participants signed up for the study on the University's SONA system, which meant that they were either university students or local residents. The sample was unselected but excluded those whose first language was not English or who were diagnosed with a specific learning disability. Written consent was obtained in accordance with the ethics procedure set out by the University Research Ethics

Committee.

Materials

Session 1. For each participant, materials included an information sheet, consent form, demographics sheet, the reading comprehension section of the ND (Brown, Fishco & Hanna, 1993, Form G), the NART (Nelson, 1982) and the IRI (Davis, 1980). The demographics sheet asked for participants' age and sex. The ND included seven passages and 38 accompanying multiple-choice questions. The NART included 50 words, each presented on their own. The IRI was made up of 28 items that pertained to one of four scales: "fantasy," "perspective-taking," "empathic concern," and "personal distress". Items were rated on a 5-point-scale (from A, does not describe me well to E, describes me very well). Participants' IRI scores were not used in subsequent analyses for this paper, except to match conditions, because the point of this paper is to explore the effects of perspective-taking strategies on comprehension rather than the impact of individual differences, in regards to empathy levels, on the usefulness of the strategies.

Session 2. Participants' second session took place between one and seven days after their first session, to give the experimenter enough time score to their ND and NART and assign them to their condition. For each participant**,** materials included six excerpts from *Dubliners* a packet of twelve (two per excerpt) Brief Mood Introspection Scales (BMIS) (Mayer & Gaschke,1988), an answer packet with comprehension questions and a packet of lined paper for participants to write out what they remembered from the excerpts[9]. All the materials were presented on A4-sized white paper. The BMIS includes 16 mood adjectives that might apply to the reader. Each adjective is rated on a 4-point scale (from definitely do not feel to definitely feel). The mood

[9] Although collected, participants' memory for the excerpts was not included in the manuscript because the focus of the current study is narrative comprehension and arousal, rather than memory for the texts.

adjectives that comprised the arousal subscale included: active, caring, fed up, gloomy, jittery, lively, loving, nervous, peppy and sad; plus two which were negatively scored: calm and tired.

The six *Dubliners* excerpts were written in 14 pt. Cambria font with 1.5-line spacing. The four excerpts from Araby ("Passage 1" to "Passage 4") were each between 274 and 399 words and included the text from, "When the short days of winter[…]" to "'I'm afraid you may put off your bazaar for this night of Our Lord'" (Joyce, 1914, pp. 14-16) . The two excerpts from Eveline ("Passage 5" to "Passage 6") were 305 and 347 words, respectively and included the text from, "She sat at the window[…]" to "and then she had begun to like him" (Joyce, 1914, pp. 19-20). Without sacrificing narrative coherence, two short sections from the selected text were excluded in order to avoid the last two excerpts becoming too lengthy: "And yet during all those years" to "'He is in Melbourne now'" (p. 19) and "But in her new home, in a distant unknown country" to "she did not find it a wholly undesirable life" (pp. 19-20). The excerpts from Araby and Eveline were presented in sequential order in order to maintain narrative coherence.

In terms of the overlap with Cupchik et al. (1998), only one out of four of the original stories was used in Experiment 1: Araby, the story of an unnamed adolescent boy's infatuation with his friend's older sister. Another story from *Dubliners*, Eveline, was used; the story of a young woman deciding whether or not to move out of her family home to marry her boyfriend. Araby and Eveline were specifically chosen because the experiences of the protagonist were thought to be relatable to those of the young adult participants. In the answer packet, the comprehension questions for each excerpt were presented on their own page. There were between four to eight comprehension questions for each excerpt. Overall, there were eight questions to test participants' understanding of literal emotion information, eight inferential emotion

questions, eight literal spatial questions, and eight inferential spatial questions.

Design

There were four independent variables: perspective-taking prompt (three levels: action-simulation, empathic and no prompt), question content (two levels: emotional and spatial), question type (two levels: literal and inferential) and excerpt (six levels: four from Araby and two from Eveline). For the F1 by-subject analyses, condition was a between-subject variable, and question content, question type and excerpt were repeated-measures variables. For the F2 by-item analyses, condition was a repeated-measures variable and, question content, question type and excerpt were between-items variables. There were two dependent variables: the number of comprehension questions correct and changes in arousal (which includes the moods: active, caring, fed up, gloomy, jittery, lively, loving, nervous, peppy and sad; plus two which were negatively scored: calm and tired) after reading compared to before reading.

Procedure

Session 1. All participants were tested individually. Session 1 took place in a testing room on campus, which included two chairs, a table and a computer. The session took around 35 minutes. The experimenter first administered the information sheet, followed by the consent form and the demographics sheet. Next, participants were given 20 minutes to complete the Nelson-Denny Reading Comprehension Test, which was the amount of time allocated in the original instructions. The questions that participants did not have time to answer were marked as incorrect. After that, participants completed the NART. After the instruction slide (“For this task please read aloud each word as it appears on the screen. Please guess if you do not know the word”), each subsequent slide included one of 50 words from the NART. Participants controlled the speed of the task, i.e., after reading each word they would click the spacebar to see the next slide.

Finally, participants were asked to fill out the IRI questionnaire, in their own time, with a pen.

Session 2. Participants' second session was scheduled between one and seven days after their first session. Before the start of the second session, the experimenter scored the participants' ND and NART to assign participants to one of the conditions, whilst ensuring the means and SDs for the ND and NART were similar across all three conditions. To start the second session, the researcher read the instructions for the reading and question-answering task to participants from a script to make sure she was consistent across participants. The task took participants around 65 minutes. Participants were instructed that they would read to themselves six excerpts from *Dubliners*, a collection of short stories by James Joyce. After reading each excerpt, they were instructed to answer four to eight comprehension questions and to write out what they remembered from the excerpt. The recall data collected will not be discussed in this particular paper, because participants' responses to literal comprehension questions were thought to provide enough of an indication of participants' memory for the excerpts. In addition, participants were instructed to fill out the BMIS immediately before and after reading each passage and to indicate how they felt at the particular moment they were filling out the questionnaire. There were separate packets for comprehension questions (each excerpt's questions had its own page), recall (each excerpt was allocated a blank, lined page), and the mood questionnaires. The researcher was in charge of keeping the participant on track (giving the participant the correct packet or passage). All participants read the passages in the same order: first, the four Araby excerpts, in order, and then the two Eveline excerpts, again, in order. Before reading each passage, participants in the no prompt condition were instructed to "read the passage as you would normally." Participants in the action-simulation reader

condition were instructed: “while reading, imagine yourself moving through space as the protagonist: seeing what the protagonist is seeing and performing the actions of the protagonist.” Finally, the empathic reader participants were instructed to “while reading, empathise with the protagonist. Try and feel the emotions that the protagonist is feeling.”

Scoring

Nelson-Denny Reading Comprehension Test. Participants were given one point for every multiple-choice comprehension question they answered correctly. There were 38 items in total.

National Adult Reading Test. The experimenter noted every time a participant mispronounced a word. The number of words pronounced correctly corresponded to participants’ predicted Verbal IQ, which was the score used in subsequent analyses (Nelson, 1982).

Interpersonal Reactivity Index. Any negative items were reverse coded. The items within each scale (fantasy, perspective-taking, empathic concern and personal distress) were averaged together.

Comprehension. Comprehension responses were scored using an answer key generated by the experimenter. Participants could earn up to one point per answer (.5 points were awarded for relevant partial answers). There were between four and 8 comprehension questions per passage. In total there were 8 literal and 8 inferential emotional comprehension questions and 8 literal and 8 inferential spatial comprehension questions. Comprehension performance was scored by one rater, but a second rater scored 10% of responses for all test sessions, Kappa = .986, $p < .001$

Changes in feelings of arousal as a function of reading. Calm and tired were reverse coded. The pre-reading score for each mood for each excerpt was subtracted

from its post-reading score. Finally, an average of all the difference mood scores along the aroused/calm dimension was computed for each excerpt.

Results

1. **The impact of being given an action-simulation (protagonist's perspective) versus empathic (protagonist's perspective) versus no perspective-taking prompt on comprehension performance.**

It was predicted that young adults in the action-simulation condition would perform better on spatial-based literal and inferential comprehension questions than participants in the two other conditions and that young adults in the empathic condition would perform better on emotion-based literal and inferential comprehension questions than participants in the two other conditions. A mixed 3(condition: no prompt, action-simulation perspective-taking and empathic perspective-taking) x 2(question-content: emotional and spatial) x 2(question-type: literal and inferential) F1 ANCOVA and F2 ANOVA were used to explore the effect of perspective-taking prompts on participant's comprehension. All F1 ANCOVAs for Experiment 1 included the NART and ND scores as covariates. See Table 2 for the means and SDs of participants' performance on literal and inferential emotional and spatial questions for each condition.

Table 2

Experiment 1 comprehension performance

		No prompt		Action-simulation perspective taking		Empathic perspective taking	
		N = 20		*N* = 20		*N* = 20	
Question Content	Question Type	*M*	*SD*	*M*	*SD*	*M*	*SD*
Emotion questions	Literal (8)	4.68	1.57	5.15	1.50	5.00	1.63
	Inference (8)	4.75	1.34	4.33	1.55	4.83	1.41
Spatial questions	Literal (8)	3.43	1.21	3.73	1.59	4.30	1.40
	Inference (8)	4.00	1.08	4.23	1.46	3.85	1.69

There were no main effects of condition, question-content or question-type on participants' comprehension performance, *ps* > *.188, ns*. In terms of covariates, the ND significantly impacted participants' performance, $F_1(1,55) = 8.013$, $p = .006$, $\eta_p^2 = .127$.

In terms of interactions, the F2 analysis revealed a significant condition x question content x question type interaction, $F_1(2, 55) = 2.36$, $p = .104$, *ns*, $\eta_p^2 = .079$, $F_2(2,56) = 3.48$, $p = .038$, $\eta_p^2 = .111$. The three-way interaction was broken down by running separate mixed 3(condition) x 2(question-type) F1 ANCOVAs/ F2 ANOVAs for each question content category.

Emotional Questions:

The 3(condition) x 2(question-type) analyses for emotional questions revealed no main-effects of condition or question-type, *ps* > .501. The F2 ANOVA revealed a close-to-significant condition x question type interaction, $F_1(2, 55) = 1.29$, $p = .285$, *ns*, $\eta_p^2 = .045$, $F_2(2, 28) = 3.22$, $p = .055$, *ns*, $\eta_p^2 = .187$, and the F1 ANCOVA revealed that ND significantly impacted the results as a covariate, $F_1(1, 55) = 11.21$, $p = .001$, $\eta_p^2 = .169$. Figure 1 suggests that the action-simulation prompt improved participants' performance on emotional literal questions compared to controls and negatively affected

their performance on emotional inferential comprehensions questions compared to both other conditions. After applying a Bonferroni correction, F1 (independent samples) and F2 (paired-samples) t-tests determined that none of the differences between conditions were significant, *ps* > .114, *ns*. In contrast to predictions, young adults in the empathic perspective-taking condition did not perform better on emotional literal and inferential comprehension questions than participants in the other two conditions.

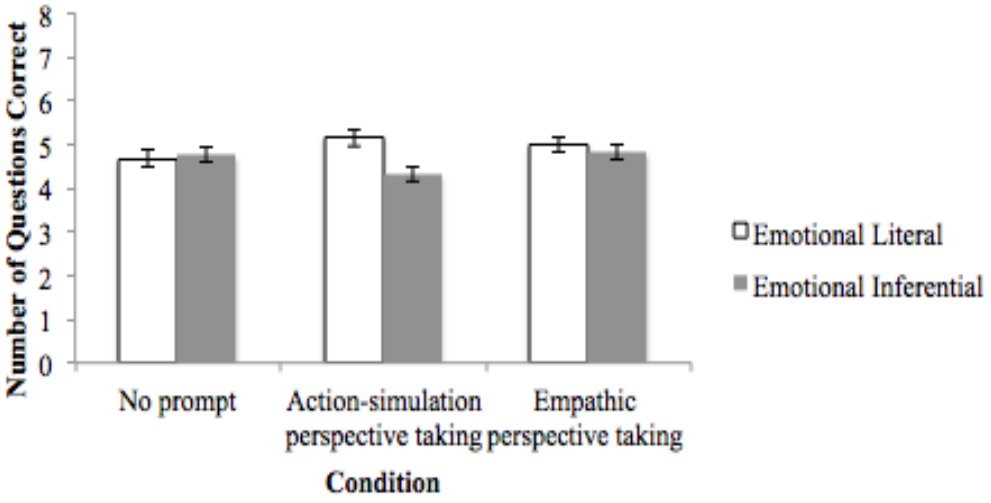

Figure 1. The number of emotion-based comprehension questions correct (maximum correct: 8) as a function of question type and condition (+/- SEM).

Spatial Questions:

For the spatial comprehension questions, the 3(condition) x 2(question-type) F1 ANCOVA and F2 ANOVA both revealed a close-to-significant condition x question type interaction, $F_1(2, 55) = 2.57$, $p = .086$, *ns*, $\eta_p^2 = .085$, $F_2(2, 28) = 2.80$, $p = .078$, *ns*, $\eta_p^2 = .167$. Figure 2 suggests that the empathic prompt improved participants' performance on spatial literal questions compared to the other two conditions. After applying a Bonferroni correction, F1 (independent samples) and F2 (paired-samples) t-tests determined that none of the differences between conditions were significant, *ps* > .123, *ns*. Contrary to predictions, young adults in the action-simulation perspective-

taking condition did not perform better on spatial literal and inferential spatial-based comprehension questions than participants in the two other conditions.

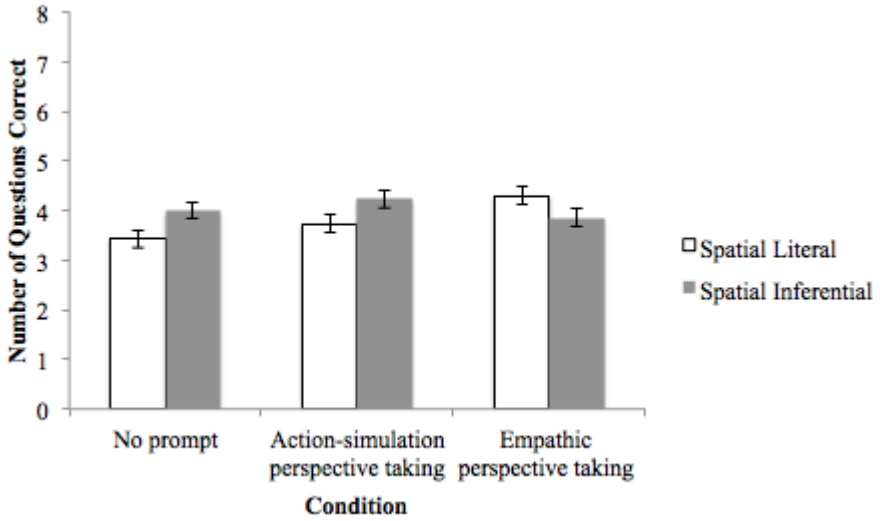

Figure 2. The number of spatial-based comprehension questions correct (maximum correct: 8) as a function of question type and condition (+/- SEM).

2. **The impact of being given an action-simulation (protagonist's perspective) versus empathic (protagonist's perspective) versus no perspective-taking prompt on arousal.**

It was predicted that young adults in both perspective-taking conditions would experience increased emotional arousal as a function of reading compared to participants in the no-prompt control condition. A 6(excerpts: 4 from Araby and 2 from Eveline) x 3(condition) ANCOVA (covariates: NART and ND) was conducted to measure the effects of condition and excerpt on changes in feelings of arousal as a function of reading (after reading minus before reading). See Table 3 for the means and SDs of participants' arousal (after reading minus before reading) for each condition.

Table 3

Arousal

		No prompt		Action-simulation perspective-taking		Empathic perspective-taking	
		N = 19		*N* = 20		*N* = 20	
Excerpt	Changes in _____ as a function of reading (after reading minus before reading)	*M*	*SD*	*M*	*SD*	*M*	*SD*
	Arousal	-.009	.078	.003	.091	.081	.093
Araby							
1	Arousal	-.026	.198	-.008	.200	-.013	.146
2	Arousal	.035	.208	-.004	.147	.138	.239
3	Arousal	-.075	.208	-.008	.209	.067	.164
4	Arousal	.018	.156	.004	.144	.092	.209
Eveline							
5	Arousal	.013	.223	-.017	.203	.054	.180
6	Arousal	-.035	.163	.050	.163	.146	.265

The analysis revealed a main effect of condition, $F(2,57) = 6.00$, $p = .004$, $\eta_p^2 = .182$. Supporting predictions, pairwise comparisons (Bonferroni corrected) revealed that participants in the empathy condition were more emotionally engaged than participants

in the action-simulation, $p = .023$, and no prompt, $p = .007$, conditions (demonstrated in Figure 3). Contrary to predictions, participants in the action-simulation condition were not more emotionally engaged as a function of reading than participants in the no-prompt condition. In addition, there was no main effect of excerpt, no excerpt x condition interaction, nor a significant effect of either covariate, *ps* > .169, *ns*.

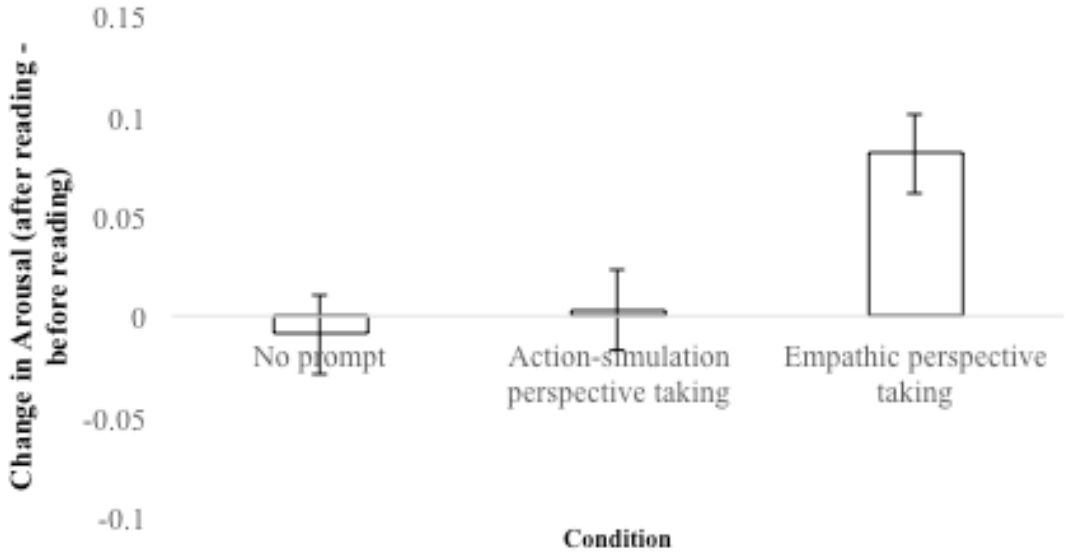

Figure 3. The effect of perspective-taking prompt on arousal (+/- SEM).

Discussion

The aims of Experiment 1 included exploring the effects of encouraging young adults to imagine themselves as the protagonist, either emotionally or spatially, on their literal and inferential comprehension of emotional and spatial information in excerpts from *Dubliners* by James Joyce. Experiment 1 also aimed to explore the effects of the perspective-taking prompts on changes in feelings of arousal (i.e., an indication of emotional reactivity to the narrative texts). The action-simulation (i.e., spatial) prompt encouraged participants to imagine themselves performing the actions of the protagonist and seeing what the protagonist is seeing, whilst the empathic (i.e., emotional) prompt encouraged participants to feel what the protagonist is feeling. It was predicted that participants given the action-simulation prompt would perform better on spatial

comprehension questions compared to participants given the empathic prompt or no prompt. It was also predicted that participants given the empathic prompt would perform better on emotional comprehension questions than participants in the two other conditions. In terms of arousal, it was predicted that participants in either perspective-taking prompt condition would report feeling more aroused after reading compared to the no prompt condition.

In contrast to predictions, neither perspective-taking prompt was found to significantly improve readers' comprehension performance compared to controls. In line with the predictions, participants in the empathic condition experienced a greater shift in arousal as a function of reading compared to participants in the action-simulation and control conditions. Thus, although empathising with the protagonist did not improve readers' comprehension of narrative texts, the prompt did make readers more emotionally reactive to the narrative situation. In order to further explore the potential benefits of emotion-based perspective-taking on young adults' comprehension of narrative texts, Experiment 2 compared the benefits of encouraging participants to either (1) empathise with a story's main character, like in Experiment 1, (2) sympathise with the main character from an outsider's' perspective or (3) read as they would normally (same control as the no prompt condition in Experiment 1).

In terms of the limitations of Experiment 1, the emotion-based and spatial-based question did not always directly relate to the protagonist. For example, the emotion-based questions sometimes related to how another character felt about the protagonist, rather than how the protagonist was feeling (e.g., Araby Excerpt 1: How do you think the protagonist's uncle feels about them [including the protagonist] playing?). In terms of the spatial-based questions, they were sometimes about a place that the protagonist was not located in over the course of the narrative situation (e.g, Eveline Excerpt 5:

What replaced the field near her house?). In order to rectify this issue, Experiment 2 specifically measured participants' comprehension of information about the protagonist and information not about the protagonist. Additionally, information about the protagonist was further subdivided into emotional and non-emotional information, which was exploratory. In conclusion, whilst Experiment 1 found that encouraging young adults to feel what the main character is feeling improved their arousal, the effect of perspective-taking on readers' comprehension of narrative texts is still unclear.

Experiment 2:

Young adults reading experimental, narrative passages from the emotional perspective of the protagonist (empathising) or a spectator (sympathising) versus no prompt

Predictions

3. **Comprehension:** Based on the findings from Experiment 1, it was predicted that participants given an emotion-based perspective-taking prompt (either to empathise or to sympathise with the protagonist) would perform better on comprehension questions than participants given no prompt. The empathy versus sympathy comparison was exploratory.
4. **Arousal:** Because of the positive impact of empathic perspective-taking on arousal after reading passages from *Dubliners*, it was predicted that participants in the empathic and sympathetic conditions would report feeling more emotionally engaged compared to participants in the no prompt condition. The empathy versus sympathy comparison was exploratory.

Methods

Participants

Fifty-four volunteers participated in Experiment 2 (M = 21.02 years old, SD = 3.78 years; *range* = 18 to 35; men = 9, women = 45). Participants were divided into three perspective-taking conditions: empathic, sympathetic, or no prompt, which were

matched on sex (there were 3 men and 15 women in each condition) age, reading comprehension ability (measured by the ND), verbal IQ (measured by the NART) and the four IRI subscales. See Table 4 for participant characteristics and one-way ANOVAs that demonstrate conditions were matched on the various characteristics.

Table 4

Experiment 2 participant characteristics

	No prompt		Empathic perspective-taking		Sympathetic perspective-taking			
	N = 18		*N* = 18		*N* = 18			
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(2,51)	*p*
Age	19.81	2.97	21.61	3.54	20.33	3.22	0.51	.603
Reading Comprehension (ND)	31.39	2.91	31.63	4.79	31.17	3.79	0.03	.975
Verbal IQ (NART)	110.83	6.41	111.89	6.13	109.61	5.29	0.66	.522
IRI Scales:								
Fantasy Scale	3.09	0.50	3.25	0.40	3.20	0.56	0.54	.588
Perspective-Taking Scale	3.36	0.52	3.29	0.42	3.29	0.35	0.16	.851
Empathic Concern Scale	3.17	0.29	3.18	0.34	3.10	0.25	0.34	.716
Personal Distress Scale	2.94	0.45	2.88	0.46	2.87	0.35	0.16	.856

Participants signed up for the study on the University's SONA system, which meant that they were either university students or local residents. The sample was unselected but excluded those whose first language was not English or those who were diagnosed with any specific learning disability. Written consent was obtained from each adult in accordance with the ethics procedure set out by the University research Ethics Committee.

Materials

Session 1. Materials for Session 1 were exactly the same as Experiment 1 and included an information sheet, consent form, demographics sheet, the reading comprehension section of the ND, the NART and the IRI.

Session 2. For each participant, materials included four stories written by the first author, a packet of eight (two per excerpt) Brief Mood Introspection Scales (BMIS), a packet of distractor tasks (four pages of addition problems), an answer packet with literal and inferential comprehension questions, focused on emotional and non-emotional character information and non-character information, and a packet with lined blank pages for participants to write out what they remembered from the stories. All the materials were presented on A4-sized white paper. The four stories were written in 14 pt. Cambria font with 1.5-line spacing. The stories were written in the third person and included a protagonist who was clearly the main focus of the story: Kathy, Marcia, John and Greg. Each story was entitled: "[the character]'s Story" and was between 239 and 313 words (see Appendix VII for an example test story and corresponding comprehension questions).

Because the four stories were written to be read by both 9 to 10-year-old children (Experiment 3) and young adults, a distractor task was added to Experiment 2, only, to increase the difficulty of the comprehension task for adult participants in order to compare children and adult's performance (see Experiment 3 for this analysis). Each page of the distractor-task packet included 64 three-digit addition problems that were randomly generated by http://www.samplewords.com/home-mathworksheets.html. All participants were given the same four pages of problems in the same order. In the answer packet, the comprehension questions for each story were presented on their own page. There were 12 comprehension questions for each story. Overall, there were eight

questions to test participant's understanding of literal emotional character information, eight inferential emotional character questions, eight literal non-emotional character questions, eight inferential non-motional character questions, eight literal non-character questions and eight inferential non-character questions. There were an equal number of questions from each category for each story.

Design

There were three independent variables: prompt condition (three levels: empathic perspective-taking, sympathetic perspective-taking and no prompt), question content (three levels: emotional character questions, non-emotional character questions and non-character questions) and question type (two levels: literal and inferential). For the F1 by-subject analyses, condition was a between-subject variable and question content and question type were repeated-measures variables. For the F2 by-items analyses, condition was a repeated-measured variable and question content and question type were between-item variables. There were two dependent variables: the number of comprehension questions correct and changes in arousal (after reading minus before reading).

Procedure

Session 1. All participants were tested individually. Session 1 took place in a testing room on campus, which included two chairs, a table and a computer. The session took around 35 minutes. The experimenter first administered the information sheet, followed by the consent form and the demographics sheet.

Session 2. Participants' second session was scheduled between one and seven days after their first session. As in Experiment 1, the researcher started the session by reading the instructions for the reading and post-reading tasks to participants from a script. The task took participants around 45 minutes. Participants were instructed they

would read four stories to themselves. There were four different orders the stories could be administered in, evenly distributed across the three conditions. After reading each excerpt, participants were instructed to answer twelve comprehension questions per story and then to write out what they remembered from each story. In addition, participants were instructed to fill out the BMIS immediately before and after reading each passage and to indicate how they felt at the particular moment they were filling out the questionnaire. There were separate packets for comprehension questions (each excerpt's questions had its own page) and the mood questionnaires. The researcher was in charge of keeping the participant on track (giving the participant the correct packet or passage). In contrast to Experiment one, before reading each story, participants were told the name of the story's main character. Each story was entitled [The main character's name]'s Story. As in Experiment 1, participants in the no prompt condition, were instructed to "read the passage as you would normally." Participants in the empathy condition were instructed, "while reading the story, imagine yourself to be [the main character]. Feel the emotions he/she is feeling." Participants in the sympathy condition were instructed "while reading the story, think about what is going on in the scene. Care about how [the main character] is feeling.

Scoring

Nelson-Denny Reading Comprehension Test. Participants were given one point for every multiple choice comprehension question they answered correctly. There were 38 items in total.

National Adult Reading Test. The experimenter noted every time a participant mispronounced a word. The number of words pronounced correctly corresponded to participants' predicted Verbal IQ, which was the score used in subsequent analyses (Nelson, 1982).

Interpersonal Reactivity Index. Any negative items were reverse coded. Then, the average response for each of the four scales (fantasy, perspective-taking, empathic concern and personal distress) for each participant was computed.

Comprehension. Comprehension responses were scored using an answer key generated by the experimenter. Participants could earn up to one point per answer (.5 points were awarded for relevant partial answers), Kappa = .993, $p < .001$.

Results

1. **The impact of being given an empathic (protagonist's perspective) versus sympathetic (spectator's perspective) versus no perspective-taking prompt on comprehension performance.**

It was predicted that participants in either the empathy or sympathy condition would perform better on comprehension questions than participants in the no-prompt condition. A mixed 3(condition: no prompt, empathic perspective-taking and sympathetic perspective-taking) x 3(question-content: emotional character information, non-emotional character information and non-character information) x 2(question-type: literal and inferential) F1 ANCOVA and F2 ANOVA were used to explore the impact of the reading prompts on participant's comprehension. All F1 ANCOVAs for Experiment 2 included the NART and ND scores as covariates. It is important to note that the assumption equality of error variances was not met for the no prompt condition (by-items), $F_2(5,42) = 4.35$, $p = .003$. See Table 5 for the means and SDs of participants' performance on literal and inferential emotional character, non-emotional character and non-character questions for each condition.

Table 5

Experiment 2 comprehension performance

		No prompt *N* = 18		Empathic perspective-taking *N* = 18		Sympathetic perspective-taking *N* = 18	
Question content	Question type	*M*	*SD*	*M*	*SD*	*M*	*SD*
Emotional Character	Literal (8)	5.50	1.41	5.92	0.96	6.75	0.84
	Inferential (8)	6.17	1.18	5.53	1.49	5.36	1.19
Non-emotional Character	Literal (8)	6.14	0.98	5.78	1.15	5.94	1.15
	Inferential (8)	7.11	0.76	7.06	0.84	6.81	1.06
Non-character	Literal (8)	6.19	1.68	5.22	1.47	6.22	1.53
	Inferential (8)	5.00	1.22	4.97	1.54	5.67	1.22

The F2 ANOVA revealed a main effect of condition, $F_1(2,49) = 1.02$, $p = .370$, *ns*, $\eta_p^2 = .040$, $F_2(2,84) = 5.85$, $p = .004$, $\eta_p^2 = .122$. Contrary to predictions, pairwise comparisons (all Bonferroni corrected) revealed that, empathic perspective takers performed significantly worse than sympathetic perspective takers, $p_1 = .516$, *ns*, $p_2 = .011$, and close-to-significantly worse than participants in the no prompt condition, $p_1 = .989$, $p_2 = .058$, *ns*, both by-items only. Contrary to predictions, there was no difference in performance between participants in the sympathetic and no prompt condition, $p_s = 1.00$, *ns*.

In addition, the F1 ANCOVA revealed a significant main effect of question content, $F_1(2, 49) = 3.84$, $p = .025$, $\eta_p^2 = .073$, $F_2(2,42) = 1.54$, $p = .225$, *ns*, $\eta_p^2 = .068$. Participants performed better on non-emotional character questions than emotional

character questions, by-participants only, $p_1 < .001$, $p_2 = .802$, *ns*, and non-character questions, $p_1 < .001$, $p_2 = .270$, *ns*. There was no overall difference between emotional character questions and non-character questions, $p_1 = .135$, *ns*, $p_2 = 1.00$, *ns*, by-participants only.

Finally, both analyses revealed significant condition x question content x question type interaction, $F_1(4,98) = 4.62$, $p = .002$, $\eta_p^2 = .159$, $F_2(4, 84) = 5.54$, $p = .001$, $\eta_p^2 = 209$. In terms of covariates, ND close-to-significantly impacted the results, $F_1(1,49) = 3.60$, $p = .064$, *ns*, $\eta_p^2 = .068$. To unpack the three-way interaction and explore the effects of condition for each question category, six one-way F1 ANCOVAs/F2 ANOVAs were run.

Emotional Character Questions:

In support of predictions, Figure 4 suggests that participants given the sympathetic prompt performed better on literal emotional character questions than participants in the other two conditions. The Figure also suggests that participants given the empathic prompt performed better than controls on the literal emotional questions and that controls performed better on inferential questions than participants in the other two conditions.

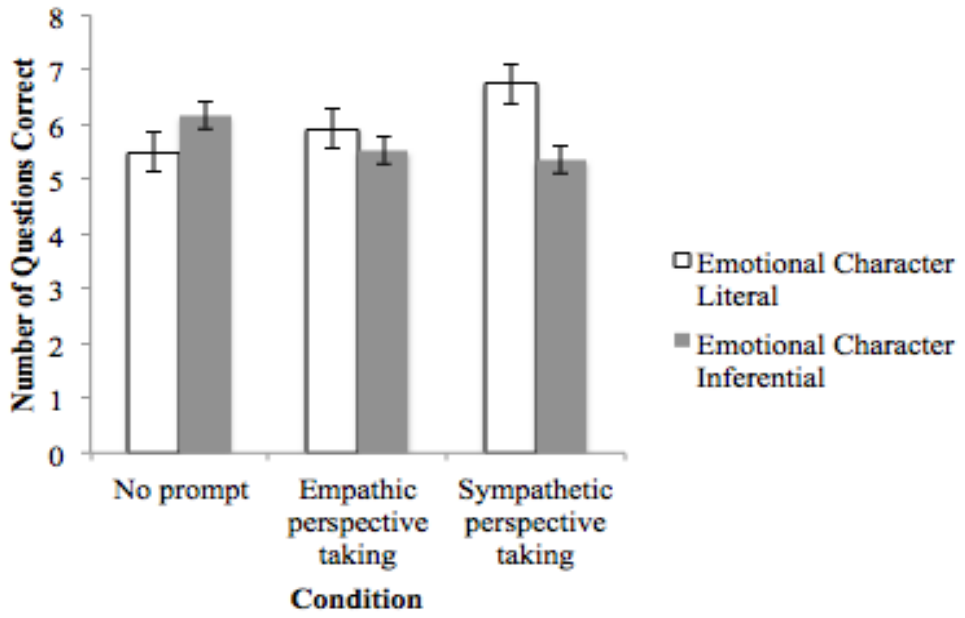

Figure 4. The number of emotional character questions correct (maximum correct: 8) as a function of question type and condition (+/- SEM)

Literal. Both analyses revealed a main effect of condition, $F_1(2,49) = 5.77$, $p = .006$, $\eta_p^2 = .191$, $F_2(2,14) = 14.84$, $p < .001$, $\eta_p^2 = .679$. In support of predictions, pairwise comparisons (Bonferroni corrected) revealed that sympathetic perspective takers performed better than controls, *ps* < .07. Contrary to predictions, but interestingly, sympathetic perspective-takers also performed better than empathic perspective takers, by-items only, $p_1 = .100$, *ns*, $p_2 = .016$. Contrary to predictions, there was no difference in performance between empathic perspective takers and controls, *ps* > .386.

Inferential. Contrary to predictions, there was no main effect of condition for either analysis, *ps* > .158, *ns*.

Non-emotional Character Questions:

Contrary to predictions, Figure 5 suggests that there was no effect of condition on either question type, which was supported by the one-way analyses on literal, *ps* > .170, *ns*, and inferential questions, *ps* > .589, *ns*. In terms of covariates, there was a

significant effect of NART on participants' performance on literal questions, $F_1(1,49) = 10.57$, $p = .002$, $\eta_p^2 = .177$.

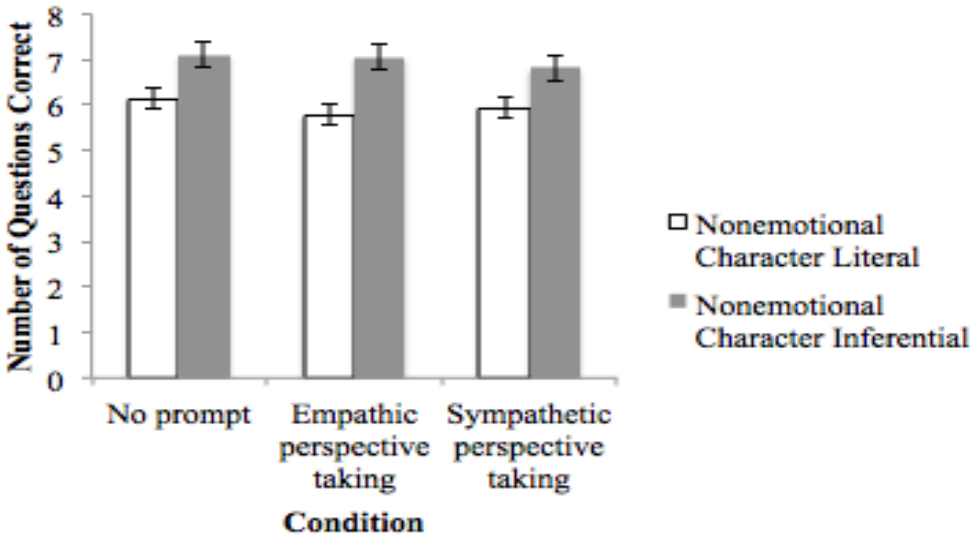

Figure 5. The number of non-emotional character questions correct (maximum correct: 8) as a function of question type and condition (+/- SEM).

Non-character questions:

In support of predictions, Figure 6 suggests that participants encouraged to empathise with the protagonist performed worse on literal non-character questions than participants in the other conditions. Also in support of predictions, The Figure also suggests that participants encouraged to adopt the perspective of a sympathetic spectator performed better on inferential non-character questions than participants in the other two conditions.

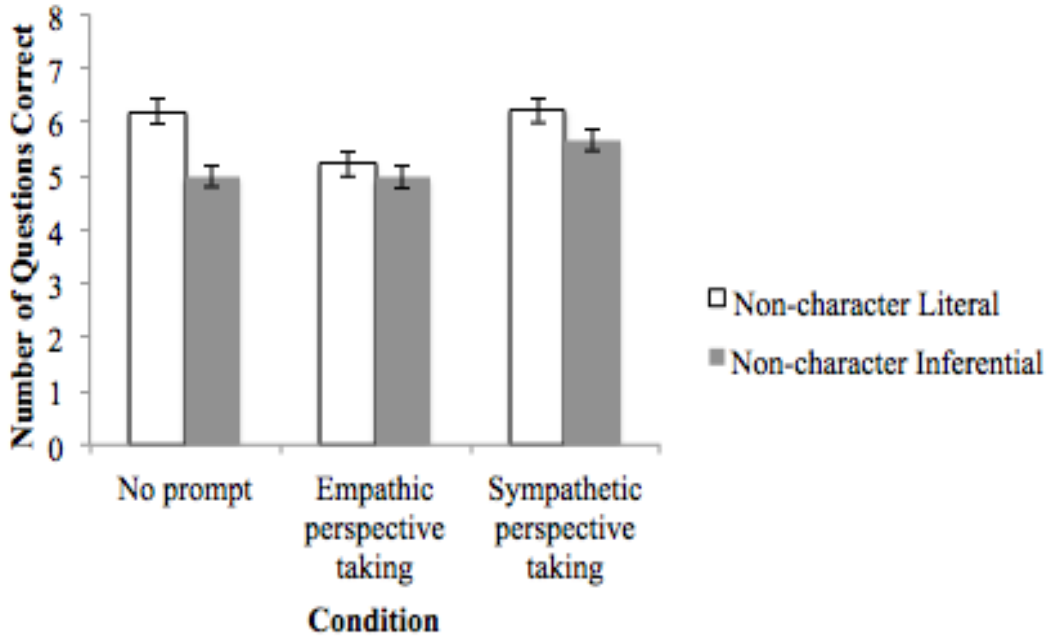

Figure 6. The number of non-character questions correct (maximum correct: 8) as a function of question type and condition (+/- SEM)

Literal. There was a marginal main effect, by-participants and a significant main effect, by-items, $F_1(2,49) = 2.54$, $p = .089$, $\eta_p^2 = .094$, *ns*, $F_2(2,14) = 6.72$, $p = .009$, $\eta_p^2 = .490$. In contrast to predictions, pairwise comparisons (Bonferroni corrected) revealed that empathic perspective takers performed significantly worse than sympathetic perspective takers, by-items only, $p_1 = .148$, *ns*, $p_2 = .021$, and close-to-significantly worse than no prompt, also by-items only, $p_1 = .195$, *ns*, $p_2 = .062$, *ns*. Also in contrast to predictions, there were no difference between sympathetic perspective takers and controls, *ps* = 1.00, *ns*.

Inferential. There was a main effect of condition, by-items only, $F_1(2,49) = 1.59$, $p = .213$, *ns*, $\eta_p^2 = .061$, $F_2(2,14) = 4.54$, $p = .030$, $\eta_p^2 = .393$. In support of predictions, pairwise comparisons found that sympathetic perspective takers performed better than controls, by-items only, $p_1 = .395$, *ns*, $p_2 = .028$. There were no other differences between conditions, *ps* > .235, *ns*.

2. **The impact of being given an empathic (protagonist's perspective) versus sympathetic (spectator's perspective) versus no perspective-taking prompt on changes in adult's mood.**

A one-way 3(condition) ANCOVA (covariates: NART and ND) was conducted to measure the effect of condition on changes in feelings of arousal as a function of reading (after reading minus before reading). In contrast to predictions, the analysis revealed no main effect of condition, $F(2,48) = 1.16$, $p = .321$, *ns*, $\eta_p^2 = .046$. Thus, although Figure 7 suggests that empathic perspective takers ($M = .024$, $SD = .088$) were more emotionally engaged as a function of reading than sympathetic perspective takers ($M = -.013$, $SD = .094$) and controls ($M = -.019$, $SD = .084$), the difference was not significant.

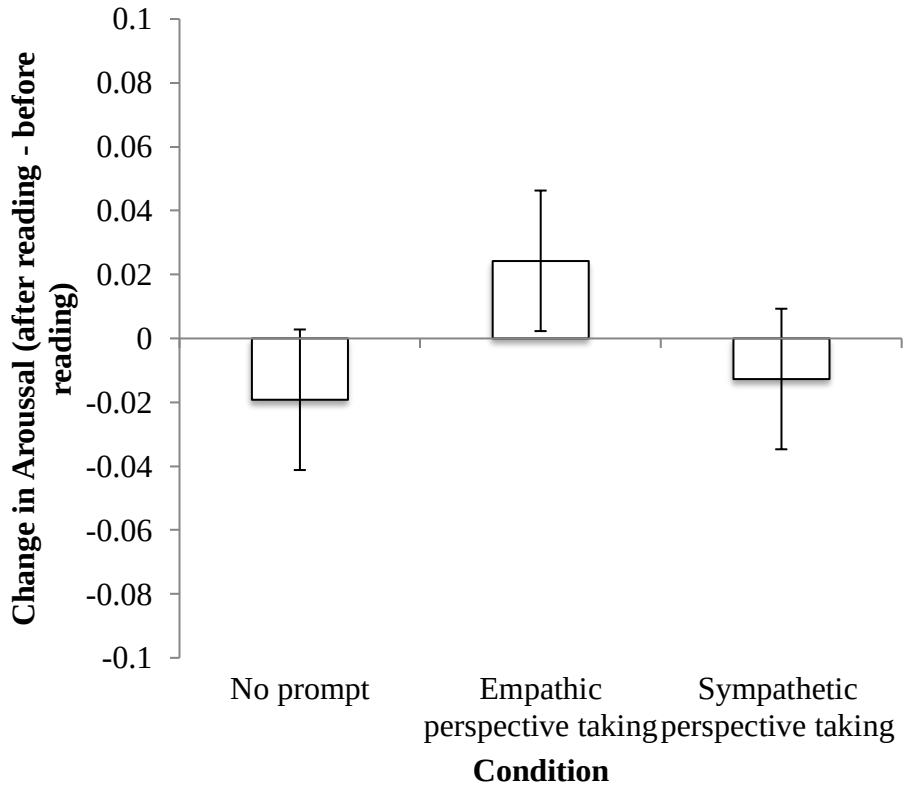

Figure 7. The effect of perspective-taking prompt on arousal (+/- SEM).

Discussion

The aims of Experiment 2 were to compare the effects of encouraging young

adults to empathise or sympathise with a story's main character (versus controls) on (1) their comprehension of literal and inferential information related or not related to the protagonist and (2) their arousal. Based on the results from Experiment 1, it was predicted that participants in either emotion-based perspective-taking condition would have improved comprehension and be more emotionally engaged compared to controls. In line with predictions, participants encouraged to adopt the perspective of a sympathetic spectator performed better on literal emotional character questions and inferential non-character questions than controls. In contrast to predictions, participants encouraged to empathise with the protagonist performed *worse* on literal non-character questions than sympathisers and controls (trend-level) and on inferential non-character questions than sympathisers, only. In addition, there was no effect of condition on participants' arousal after reading (compared to before reading).

The benefits of the sympathetic spectator prompt on comprehension performance supports Mar and Oatley's (2008) theory that skilled readers understand the emotional state of a "fictional other" by adopting the viewpoint of the observer, because that is how we relate to others in real life. The negative effect of the empathy prompt on participants' comprehension of information not related to the protagonist could be attributed to readers developing tunnel vision whilst constructing their mental models, i.e., only tracking information related to the protagonist. Alternatively, the deficit could be because participants do not automatically adopt the perspective of the protagonist whilst reading (Albrecht, O'Brien, Mason, & Myers, 1995).

In terms of the null effect of condition on arousal, although Experiment 1 found that encouraging readers to empathise with the protagonist while reading *Dubliners* improved their arousal, perhaps the materials for Experiment 2 were less emotionally engaging because they were written for Experimental purposes rather than as fiction. In

addition, because the journey of the main character in Experiment 1 spanned multiple excerpts, perhaps participants had more of an opportunity to become emotionally engaged than in Experiment 2. Experiment 3 is a replication of Experiment 2 (comprehension only) with 9 to 10-year-old children. The aims of Experiment 3, included (1) to explore the effects of emotional perspective-taking on children's comprehension of information related to the protagonist versus not related to the protagonist. Arousal was not explored in Experiment 2 because there is no BMIS equivalent for children; only pictorial scales, which are less sensitive.

Experiment 3

Children reading experimental, narrative passages from the emotional perspective of the protagonist (sympathising) or a spectator (empathising) versus no prompt

Predictions

5. **Comprehension:** Because previous research has demonstrated that children (9 to 10-year-olds) who adopt the perspective of characters while reading have improved performance on skills related to comprehension (i.e., memory for narratives), it was predicted that the empathic prompt would improve children's comprehension performance compared to the sympathetic and no prompt condition.

Participants

Thirty-three children participated in Experiment 2 (*M* = 9.79 years old, *SD* = 0.33; range = 9.17 to 10.50; boys = 15, girls = 18). They were recruited from a Year-5 cohort at a primary school in the South-East of England. Participants were divided into the same three perspective-taking conditions as Experiment 2: empathic, sympathetic, or no prompt, which were matched on age (no prompt (*M* = 9.73 years old, *SD* = 0.37 years), empathic perspective-taking (*M* = 9.90 years old, *SD* = 0.32) and sympathetic

perspective-taking (M = 9.75, SD = 0.32), $F(2,30) = 0.91$, p = .414, *ns*), listening comprehension ability (measured by the Neale Analysis of Reading Ability-R (NARA-II)), and word-reading ability (measured the Gates-MacGinitie Vocabulary Test (GM)). Four children who participated in Session 2 were absent when the baseline measures were collected (Session 1). Thus, Table 6, which includes participants' performance on the NARA-II and GM, excludes the four absent children.

Tables 6

Experiment 3 participant characteristics

	No strategy		Empathic perspective taking		Sympathetic perspective taking			
	$N = 10$ (excluding 1)		$N = 9$ (excluding 2)		$N = 10$ (excluding 1)			
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*	$F(2,26)$	*p*
Listening Comprehension (NARA)	18.60	6.12	17.22	5.51	18.35	4.07	0.18	.837
Vocabulary (GM)	35.40	5.32	35.67	5.92	35.10	4.63	0.02	.973

The sample was unselected but excluded children whose first language was not English or who were diagnosed with a specific learning disability. Written consent was obtained from a parent or guardian of each child in accordance with the ethics procedure set out by the University Research Ethics Committee. Additionally, each child was informed that they could stop and leave at any point during the study.

Materials

Group assessment. Materials included the stories and comprehension questions from Form 2 of the NARA-II (Neale, 1997) and Form T, Level 4 of the GM vocabulary test (MacGinite et al., 2000). For the NARA-II, there were five stories of increasing difficulty (Levels 2 – 6) and an answer packet with eight comprehension questions per

story. The GM included 45 multiple-choice questions. Each question included a word or phrase (e.g., “they are close”) and four options (e.g., “clean”, “at the store”, “first” and “near”) from which to choose the one that best matched the original word or phrase in meaning.

Individual testing Session. Participants were tested individually within three months of being administered the group assessments. Materials included an information/demographics sheet and the same stories and comprehension questions as Experiment 2. A digital voice recorder was used to record children’s comprehension responses. The information/demographics sheet requested participants’ sex and date of birth (to compute their age).

Design

The experimental design was the same as Experiment 2 excluding the dependent variable, changes in feelings of arousal.

Procedure

Group assessment. All students in Year 5 were administered the NARA-II and GM by their classroom teacher, two weeks before individual testing started. For the NARA-II, teachers first read out loud a practice story and then its corresponding comprehension questions. For each question, participants wrote out their response in the answer booklet. The teacher then commenced reading the test stories out loud followed by their corresponding comprehension questions. Administering the NARA-II took around thirty minutes. Afterwards, teachers read out loud the instructions for the GM, which included guiding children through the two practice questions. Participants were given twenty minutes to complete the GM.

Individual testing Session. At the start of the individual session, each participant was given an information/demographics sheet (that the experimenter read

out loud) and asked to fill in their sex and date of birth. Before reading each story, participants were given their perspective-taking prompt (the same as in Experiment 2). After the participant read each story, the experimenter read out loud the comprehension questions and audio recorded the participant's responses. The experimenter also audio recorded participants' recall of each story. The session lasted around 40 minutes for each child.

Scoring

Neale Analysis of Reading Ability II. The experimenter graded the oral comprehension assessment by comparing children's written answers to a list of acceptable answers. Children could earn up to one point per question (.5 points were also awarded for relevant partial answers). Raw scores were used in the analyses rather than standardised scores because the test was not administered according to the guidelines in the manual (it was used as a listening rather than reading comprehension assessment).

Gates-MacGinitie. For the word reading assessment, children were assigned one point for every question they answered correctly. There were 45 items in total.

Comprehension. The same scoring method was used as in Experiment 1. Young adult's and children's comprehension performance were scored by two different raters, but they made sure their scoring techniques were matched (each scored six of the other's participant transcripts, Kappa = .937, $p < .001$.

Results

1. **The impact of being given an empathic (protagonist's perspective) versus sympathetic (spectator's perspective) versus no perspective-taking prompt on children's comprehension performance.**

It was predicted that children in the perspective-taking conditions would perform

better on comprehension questions than children in the no-prompt condition. Mixed 3(condition) x 3(question-content) x 2(question-type) F1[10] and F2 ANOVAs were used to explore the effect of condition on comprehension. Table 7 includes the descriptive statistics.

Table 7

Experiment 3 comprehension performance

		No prompt		Empathic perspective taking		Sympathetic perspective taking	
		$N = 11$		$N = 11$		$N = 11$	
Question content	Question type	*M*	*SD*	*M*	*SD*	*M*	*SD*
Emotional Character	Literal (8)	5.95	1.13	6.14	0.98	5.77	1.13
	Inference (8)	4.09	0.943	3.73	0.96	4.09	1.179
Non-emotional Character	Literal (8)	5.32	0.87	5.14	0.84	5.50	0.97
	Inference (8)	5.59	0.92	5.23	1.08	5.95	1.37
Non-character	Literal (8)	6.05	0.85	6.32	1.01	6.36	1.31
	Inference (8)	4.91	1.00	4.14	1.19	3.73	1.68

In contrast to predictions, the analyses revealed a main effect of question content, by-participants only, $F_1(2,60) = 3.30$, $p = .044$, $\eta_p^2 = .099$, $F_2(2,42) = 0.24$, $p = .777$, *ns*, $\eta_p^2 = .012$, and question type, $F_1(2,30) = 65.77$, $p < .001$, $\eta_p^2 = .687$, $F_2(1,42) = 4.84$, $p = .033$, $\eta_p^2 = .103$. Specifically, participants performed better on literal than inferential questions, *ps* < *.033*, and on non-emotional character questions than emotional character questions, $p_2 = 1.00$, $p_1 = .030$. There were no differences between emotional character questions and non-character questions, *ps* > .514, and non-emotional character questions and non-character questions, *ps* > .887. There was also a significant question content x question type interaction, by-participants only, $F_1(2,60) =$

[10] No covariates were included because 4 out of the 33 children participants were absent for the group comprehension assessment.

28.53, $p < .001$, $\eta_p^2 = .485$, $F_2(2,42) = 1.81$, $p = .177$, $\eta_p^2 = .079$.

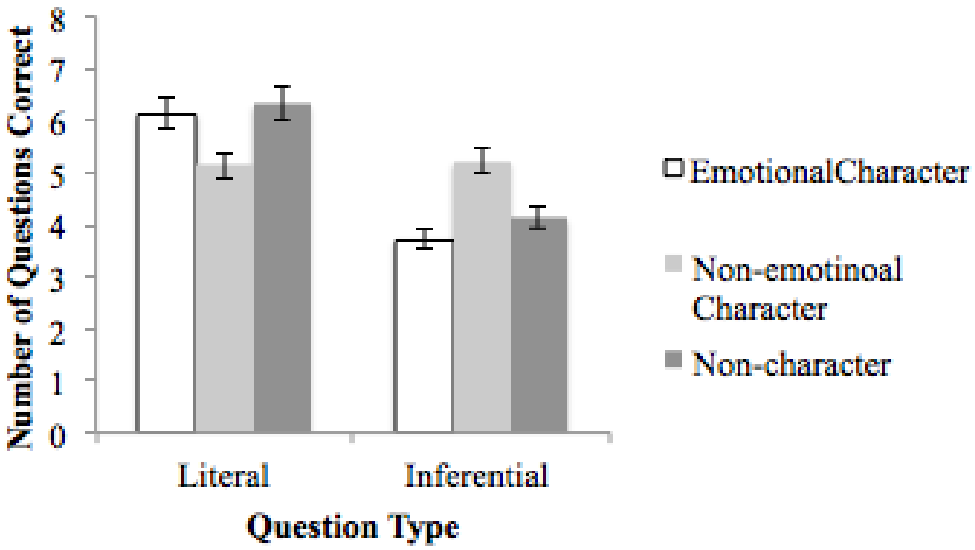

Figure 8. The number of comprehension questions correct (maximum correct: 8) as a function of question content and question type (+/- SEM).

Figure 8 suggests that the question content x question type interaction can be attributed to children performing better on literal versus inferential questions on emotional character and non-character questions but not on non-emotional character questions (i.e., no difference in performance). This was supported by literal versus inferential F1 and F2 t-tests for each question-content category. Children performed significantly better, by-participants, and close-to-significantly, by-items, on literal questions than inferential questions on emotional character questions, $t_1(32) = 8.48$, $p < .001$, *ns*, $t_2(14) = 2.04$, $p = .061$, *ns*, and on non-character questions, $t_1(32) = 6.72$, $p < .001$, *ns*, $t_2(14) = 2.00$, $p = .065$, *ns*. In contrast, there was no difference in performance between literal and inferential non-emotional character questions, $t_1(32) = 1.19$, $p = .243$, *ns*, $t_2(14) = 0.29$, $p = .776$, *ns*.

Discussion

The aim of Experiment 3 was to explore the effects of emotion-based perspective-taking on children's comprehension of narrative texts. Although the

sympathetic prompt improved adults' comprehension of narrative texts during Experiment 2 (specifically, on literal emotional character questions and inferential non-character questions), it was predicted that the empathic prompt would most benefit children's comprehension, based on previous research. Contrary to predictions, there was no significant effect of condition on comprehension performance. Instead, a significant question content x question type interaction revealed that whilst children performed significantly better on literal than inferential emotional character questions and non-character questions, there was no effect of question type on children's performance on non-emotional character questions.

General Discussion

Through a series of experiments, the current study aimed to better understand the effects of different forms of perspective-taking on reading comprehension by encouraging readers to either adopt the perspective of a story's protagonist or that of a sympathetic spectator while reading. Experiment 1 compared the effects of asking participants to adopt the perspective of a story's protagonist along two different narrative dimensions on their comprehension of emotional and spatial information in literary texts as well as their emotional arousal (Zwaan et al., 1995). Participants were either asked to imagine themselves as the protagonist, spatially (performing the actions of the protagonist, seeing what the protagonist is seeing), emotionally (feeling what the protagonist is feeing), or to read as they would normally. To ensure that participants would be able to immerse themselves into the narrative situation, they were asked to read excerpts from two emotionally engaging stories from *Dubliners* by James Joyce. We expected the spatially-driven perspective-taking prompt to improve readers' comprehension of spatial information and for the emotionally-driven perspective-taking prompt to improve their comprehension of emotional information. Instead, neither

perspective-taking condition affected participants' comprehension, and instead, emotionally-driven perspective-taking increased participants' arousal compared to the other two conditions. Thus, as Cupchik and colleagues (1998) found, encouraging readers to become emotionally involved in the protagonist's plight, while reading, heightened their emotional response to the narrative text. This finding also partially maps onto Hartung and colleagues' (2017) conclusion that readers' perspective-taking preferences predict brain-activity, while reading, over and above the perspective that the text was written from (e.g, second-person, first-person, or third-person). Although, it is important to remind the reader that Experiment 1 did not control for the perspective the *Dubliners* excerpts were written from (e.g., four of the excerpts were written from the first-person perspective, while the final two were written from the third-person perspective) nor participants' perspective-taking preferences.

In order to further understand how perspective-taking prompts affect readers' behavior, the experimental materials were revamped for Experiment 2. First off, because only the emotion-based perspective-taking prompt affected readers' behavior in Experiment 1, the experimental manipulation solely focused on emotionally-driven perspective-taking: encouraging participants to feel what the protagonist was feeling (i.e., first-person, empathising) versus the effects of encouraging participants to be a sympathetic spectator (i.e., an outsider's perspective, sympathising). Secondly, Experiment 2 included stories written, specifically, for the experiment. Thus, they were all written from the same perspective (i.e., third-person) and the comprehension questions were all of a similar difficulty. In addition, we were able to include a more subtle distinction between comprehension-question categories (emotional or non-emotional information about the protagonist or information not about the protagonist) . No predictions were made for the empathy/sympathy comparison beforehand, because

the comparison was exploratory. Interestingly, we found that encouraging readers to feel what the protagonist was feeling *negatively* impacted readers' comprehension of literal and inferential information not about the protagonist, whilst encouraging readers to sympathise with the protagonist *improved* readers' comprehension of literal *emotional* information about the protagonist and inferential information not about the protagonist.

The negative effect of the empathic prompt in Experiment 2, compared to the positive effect in Experiment 1, suggests that the quality of text may significantly impact the usefulness of empathising with the protagonist on comprehension. For example, feeling what the protagonist was feeling may have benefited readers' comprehension of *Dubliners* because the plot depended on the characters' emotional journeys more so than in the experimental stories. Interestingly, the behavioral results from Experiment 2 call into question the multi-dimensional framework of readers' mental models suggested by the Event- Indexing Model (Therriault and Rinck, 2008). Specifically, the most up-to-date version suggests there are five main narrative dimensions (that readers are monitoring while reading Experiment 3 attempted to replicate Experiment 2 with 9 to 10-year-old children in order to explore whether the perspective-taking prompts would be useful in the classroom. There was no effect of reading prompt on comprehension, which may have resulted from the small sample size.

A limitation of the current study was that there was no measure of how well participants implemented their perspective-taking strategy. The findings from the current study suggest that encouraging readers to adopt a perspective while reading can positively affect their comprehension of a narrative. Interestingly, asking readers to feel what a story's protagonist is feeling appears to either positively (while reading *Dubliners*) or negatively (while reading experimental narrative passages) influence

readers' comprehension depending on which texts they were reading (although quality of text was not formally manipulated in the current study). Future research could investigate the usefulness of perspective-taking prompts for comprehenders of varying abilities as well as how the prompts relate to what strategy readers report using normally.

Chapter 6: General Discussion

The main aims of the current thesis were to investigate the benefits of different embodiment (manipulation versus enactment) and perspective-taking strategies on children's (9 to 10-year-olds) and adults' (18 to 30-year-olds) comprehension of narrative texts. The thesis also aimed to better understand children's experience while reading normally and how that maps onto comprehension ability.

Chapter 2

Chapter 2 investigated the benefits of storyboard construction (SB), i.e., creating a visual representation of a narrative text using plastic cut-outs, on 9 to 10-year-old children's comprehension monitoring (inconsistency detection and correction during recall), story recall and coherence of recall (a proxy measure of mental model coherence). Children were asked to read a narrative text with an internal inconsistency either whilst constructing a storyboard (the SB condition) or as they would normally (the control condition). Children in the SB condition recalled more idea units and had more coherent recollections than controls. Contrary to predictions and previous research, SB had no effect on children's comprehension monitoring. One week after the original test session, children in the SB condition were asked to imagine constructing a storyboard (without the storyboard in front of them) while reading a different narrative text with an internal inconsistency. Children in the control condition were again asked to read as they would normally. The aim of the follow-up session was to determine whether children in the SB condition could maintain their advantage on recall and coherence of recall by imagining using the strategy. Although the follow-up session was exploratory, findings from Glenberg and colleagues (2004) and Marley and Szabo (2011) suggested that children would potentially be able to maintain the benefits of SB when asked to imagine using the strategy. Unfortunately, children in the SB condition

did not maintain their advantage on recall and coherence or recall compared to controls. Possible reasons for this null finding include:

1. Unlike the aforementioned past intervention studies, children were not given the opportunity to practice constructing a physical storyboard immediately before being asked to *imagine* constructing a SB (Glenberg et al., 2004; Marley & Szabo, 2010). Thus, the children who may have benefited the most from SB during the original session might have forgotten about the strategy entirely, or, more realistically, not understood how to apply the strategy, using only their imagination, to a new story in a completely different setting.
2. Compared to previous research, the two texts chosen and the expectation to freely recall the entire text (as opposed to cued-recall), may have been too difficult at baseline (although the participants were older for this study compared to past research) (Glenberg et al., 2004; Marley & Szabo, 2010) .

Interestingly, as a supplementary analysis, the study also found that children's subjective use of imagery (when reading normally) correlated with their general listening comprehension ability (NARA-II) and their comprehension monitoring performance during the follow-up session only. Thus, whilst imagining to use this particular manipulation strategy was not useful, a child's awareness of whether they use their imagination while reading positively correlated with comprehension ability (i.e., performance on the NARA-II).

The findings from Chapter 2 contrast with Rubman and Waters (2000) and call into question whether SB is an adequate strategy to improve comprehension monitoring. The null findings in respect to the measures of comprehension monitoring could be attributed to one aspect of comprehension monitoring (i.e., detecting an inconsistency) being an unanticipated outcome for readers and thus, too difficult a task (Kolić-

Vehovec, 2006; Markman, 1979). Making the process of comprehension monitoring more explict for the reader has been found to be a more effective strategy for improving comprehension monitoring (Wassenburg, Bos, de Koning, & van der Schoot, 2015).

Children's improved coherence of recall in the SB condition suggests that constructing a storyboard still benefited coherence of children's mental models. Chapter 4 investigated whether the improvement was because storyboard construction improved readers' memory for the text or because the task also improved readers' ability to integrate information in the text (i.e., make inferences). The positive correlation between how often children construct mental images when reading normally and their general listening comprehension ability suggests that children's experience of a narrative situation impacts their comprehension.

Chapter 3

Chapter 3 aimed to capture the nuances of children's own experiences while reading, and how those experiences map onto reading comprehension ability. Twenty-five of the original 35 participants from Chapter 2 were interviewed on their experiences while reading normally. The thematic analysis focused on readers' experience of mental imagery and perspective-taking. Children reported using mental imagery to help them (1) personally connect with a story and make it their own, (2) ground the text in reality and (3) fill in their gaps of understanding. Children also revealed that their mental images could be multi-modal and dynamic; thus, not only visual. The analysis unmasked three modes of perspective-taking: visualising to take perspective, simulating action to take perspective and feeling (a character's emotions) to take perspective. The majority of children reported visualising stories from an outside perspective. An unexpected finding was that some children who reported taking an outside perspective, visually, also reported adopting a characters' perspective

emotionally and/or through action. Some children who reported simulating the actions of a character explained it helped them understand difficult passages. Some children who reported thinking about how a character felt or feeling their emotions explained that it helped them understand how a character would tell the story. In terms of how children's subjective experience of reading maps onto ability, children who reported adopting a character's perspective recalled more idea units and had more coherent recollections during Chapter 2's follow-up session.

In contrast to previous research, Chapter 3 demonstrated that visual perspective-taking (i.e., seeing a narrative situation through the eyes of the protagonist or a spectator) is not the only form of perspective-taking used during reading comprehension (Barnes et al., 2014; Rall & Harris, 2000; Ziegler & Acquah, 2013). Children primarily reported adopting a character's perspective by simulating their actions and/or feeling their emotions. The fact that children who reported simulating the experience of a character had improved comprehension performance supports an embodied theory of reading comprehension. Specifically, constructing a mental model of a narrative text involves (re)activating the motoric, sensory and affective neuronal systems necessary for experiencing the narrative situation (Barsalou, 2008; de Koning, Bos, Wassenburg, & van der Schoot, 2016; Glenberg, 2011; Zwaan, 2015).

Chapter 4

Chapter 4 explored the immediate and long-term benefits of training SB and active experiencing (AE), acting out a story using emotional expression and movements, on 9 to 10-year-old children's literal and inferential comprehension of emotional and spatial information in narrative texts, as well as their memory for the narrative texts. At the beginning of the school year (T1), after a short practice session, children in the AE and SB conditions used their strategy while reading two narrative texts. Children in the

waitlist control (WL) condition read the narrative texts as they would normally. The study found that immediately after training, children in the SB condition had better memory for the narrative texts than children in the WL condition. Children in the SB condition also performed better than children in the WL and AE conditions on spatial comprehension questions. Children in the AE condition performed better than children in the WL condition on emotional comprehension questions. In between T1 and T2 (three months later), children in the AE and SB conditions took part in monthly, group top-up sessions where they practiced using their strategy and were encouraged to imagine using their strategy when reading on their own. During T2, children in the AE and SB conditions were asked to read two new narrative texts whilst imagining using their strategy and, after a short training session, children in the WL condition used SB while reading, because it was found to be the more beneficial strategy. In between T2 and T3 (three months later) children in the WL condition took part in monthly, group top-up sessions. During T3, children in all three conditions were instructed to imagine using their strategy while reading two new stories. Children in the SB condition appeared to maintain the benefits of the strategy on recall but their performance on spatial comprehension questions was worse during T2 and T3 compared to T1. Children the AE condition appeared to maintain the benefits of the strategy on emotional comprehension questions. The longitudinal analysis of the WL condition found that using the SB strategy improved children's recall and spatial comprehension performance compared to before training (T2 versus T1). During T3, children in the WL condition still had better memory for narrative texts compared to T1 but their performance on spatial comprehension questions returned to pre-training levels.

The findings from Chapter 4 extended the findings from Chapter 2 by demonstrating that SB enhanced the coherence of children's mental models by improving children's

memory for the texts *and* their ability to integrate information within the text. In addition, in contrast to Chapter 2, children in the SB and WL condition appeared to maintain the benefits of SB on recall with the addition of group top-up sessions and the opportunity to practice constructing a storyboard before imagining to construct one, similar to past, aforementioned intervention studies (Glenberg et al., 2004; Marley & Szabo, 2010). Children were unable to maintain the benefits of SB on their literal and inferential comprehension of spatial information possibly because the improved text integration required the physical manipulation of the storyboard. For SB, a possible reason there was a stronger overall effect is that the strategy makes it easier for children with more visuospatial mental imagery to construct a multi-dimensional mental model of a narrative text. Specifically, providing children with a 2-D layout of the story's setting with characters and objects to manipulate, children who have trouble constructing the visuospatial dimension of their mental model (thought by Glenberg and colleagues (1987) to be the cornerstone of mental models).

AE is harder for children to implement because, from observation, there appears to be social anxiety, even in a one-to-one situation, when children are asked to "act out" a story. In addition, it is a peculiar task to ask children to do whilst reading a narrative text (versus a script in a play). A more popular alternative to AE, not explored in the current thesis, is "Reader's Theatre," which, in short, is the conversion of a narrative text into a play-like script in order to aid students' reading fluency and comprehension (Jagger, 2008).

Chapter 4 was one of the first studies to investigate the benefits of comprehension strategies on specific dimensions (i.e., spatial and emotional information) of narrative comprehension. Specifically, children were encouraged to focus on spatial information by creating a visual representation of the narrative situation or emotional information by

acting out the narrative situation with emotional expression. In addition, similar to Chapter 3, Chapter 4 also supports the embodied theory of text comprehension, because strategies that activated motoric, sensory and affective processes improved narrative text comprehension.

Chapter 5

Chapter 5 investigated the benefits of various perspective-taking prompts on children and young adults' reading comprehension. Experiment 1 compared the effects of asking young adults (1) to simulate the actions of the protagonist (the action-simulation condition), (2) to feel the emotions of the protagonist (the empathy condition) and (3) to read as you would normally (the control condition) on their literal and inferential comprehension of emotional and spatial information in the text. Instead of reading experimental passages, participants read excerpts from *Dubliners* by James Joyce. Experiment 1 found no significant effects of condition on comprehension performance. Participants in the empathy condition experienced a greater shift in emotional arousal than participants in the action-simulation and control conditions. Experiment 2 compared the benefits of encouraging young adults to empathise or sympathise with the protagonist on their comprehension of information about the protagonist and not about the protagonist. Information about the protagonist was further subdivided into emotional and non-emotional information. Participants in the sympathy condition performed better than those in both the other conditions on emotional literal questions and better than controls on non-character inferential questions. Participants in the empathy condition performed worse than those in both the other conditions on literal non-character questions. There was no effect of condition on emotional engagement. Experiment 3 replicated Experiment 2 but with 9 to 10-year-old children. Experiment 3 found no effect of reading prompt on comprehension.

Chapter 5 mapped back to Chapter 3 by investigating what forms of perspective-taking have a positive impact on readers' comprehension of narrative texts. An interesting finding was that certain perspective-taking prompts improved young adults' comprehension of information beyond the focus of the prompt. For example, readers encouraged to sympathise with the protagonist during Experiment 2 had improved performance on non-character inferential questions compared to controls. This maps onto Chapter 4, which found that after children were encouraged to imagine constructing a storyboard, their performance on emotion-based comprehension questions improved. The benefits of storyboard construction (Chapter 4) and sympathising with the protagonist (Chapter 5) on reading comprehension suggest that encouraging readers to adopt an outsiders' perspective while reading may be particularly conducive for construction a coherent mental model of a narrative situation.

Mental Imagery Skills and Comprehension Ability

First off, Chapter 2 determined that children's awareness of how often they used mental imagery, while reading normally, correlated positively with NARA-II scores, a general measure of children's listening comprehension ability used in Chapters 2 through 5. Secondly, Chapter 3, which included 25 of the original participants from Chapter 2, found that children who reported adopting a character's perspective when reading normally had *almost* significantly ($p = .060$, *n.s.*) better NARA-II scores than children who did not report adopting a character's perspective. In addition, children who reported adopting a character's perspective also had better recall and coherence of recall of stories, during Session 2 (when there was no effect of condition), but not during Session 1 (i.e., no difference). Furthermore, children who reported perspective-taking also reported using mental imagery when reading more often than non-perspective-takers. Finally, there was no difference between perspective-takers and non-perspective-

takers on Chapter 2's measure of comprehension monitoring ability during either session or on the measure of word reading ability (the G-M). These findings demonstrate that, in particular, the general perspective-taking habits of children is positively related to their performance on some, but not all, measures of comprehension skills. It is important to point out that NARA-II is not normally administered as a group listening comprehension measure, which is how it was administered for Chapters 2, 3 (which included the same participants at Chapter 2) 4 and 5 (Experiment 3), but rather, to one child at a time to measure children's reading comprehension ability. The precedent to use NARA-II to measure listening comprehension ability was set by Oakhill and Cain (2012). Interestingly, although the thematic analysis unearthed three different forms of perspective-taking (seeing, simulating, or feeling) used by children, none of the quantitative analyses (including Experiment 3 in Chapter 5) indicated that different forms of perspective-taking used by children affected reading comprehension performance. Thus, as suggested by Zwaan (2014), exactly how children simulate a character's experience may only enrich children's mental model of a story rather than significantly improve children's comprehension. In terms of *how* mental imagery contributes to readers' mental models, Moulton and Kosslyn (2009) argue that mental imagery helps people to make predictions about future events; in this context, predictions regarding what will happen next in the narrative situation. Further research needs to be conducted to determine whether physical strategies are more beneficial than mental imagery strategies or vice versa, particularly, in terms of to what extent the strategies help readers predict future narrative events.

Limitations

The first limitation is the use of a one-item Likert scale to measure use of mental imagery when reading normally. Specifically, for Chapter 2, every participant was

asked “when you are reading books, even when they don’t have pictures in them, do you see pictures in your mind of what you’re reading?” Children were then asked to choose one of five responses: never, rarely, sometimes, a lot or always. The main issue with this scale was that there was no way to capture the idiosyncrasies and complexities of children’s mental-imagery experience. To deal with these limitations, I created a new version of the well-validated VVIQ, with the specific purpose of measuring children’s levels of mental imagery while reading a narrative text. Although the data from this alternative-VVIQ were not analysed in the current thesis, in future, it would be interesting to apply a factor analysis to determine what sorts of idea units are experienced my readers similarly and can thus, be grouped together.

One of the main limitations of the thesis was a lack of a between-subject control condition during T2 and T3 in the study reported in Chapter 4. Thus, children’s ability to maintain the benefits of AE on emotion-based comprehension questions and the benefits of SB on story recall might have instead been a function of time spent in school. To correct this limitation, in future, a similar longitudinal study could include a control condition for all three sessions. The original concern was that the control participants would be “missing out” on the benefits of the more helpful strategy, but in actual fact, the benefits were moderate and control participants, in future, could be taught how to use either strategy, instead, at the end of the study, after testing. In addition, children’s temperaments appeared to make full AE, akin to the original strategy theorised by Noice and Noice (2001) difficult. Specifically, the main researcher observed that the majority of children from Chapter 4 had trouble engaging with the task (e.g., committing to different voices for different characters, conveying emotion through voice or gesture/movement) during Session 1. In addition to temperament, children’s difficulty engaging with the task could have also been the result of confusion

compared to SB, for which the instructions were more straight-forward. In addition, unlike Cutica and colleagues (2014), we did not record children's gestures during Session 1 for children in the AE condition of the longitudinal study. Regarding Experiment 1 in Chapter 5, although a few of the same passages were used in a previous experiment with a similar age group (Cupchik et al., 1998), *Dubliners* may have been too difficult a text. Not only for the participants to comprehend, but for the experimenters to write comprehension questions of similar difficulty within and between passages. In addition, it is difficult to make firm conclusions from Chapter 5's third experiment (the replication of Experiment 2 with 9 to 10-year-old children), because the sample size was significantly smaller than Experiment 2's.

Practical implications of the thesis

All of the research included in the thesis centred around exploring strategies to improve children's reading comprehension. In addition to targeting discourse-level processes (i.e., comprehension monitoring, inference making), the studies demonstrated that different strategies could be used to improve children's comprehension of specific narrative dimensions (Chapter 4). The results from Chapter 4 extend the findings of previous physical manipulation studies by demonstrating that storyboard construction can be used to improve children's memory for and spatial-based comprehension of more complex narratives. In addition, Chapter 4 demonstrated that active experiencing can be used to improve children's emotion-based comprehension of narrative texts. Because of the limitations of Chapter 4's design, the results are inconclusive in terms of whether children can maintain the benefits of the two embodiment strategies.

The findings from Chapter 5 demonstrated that the impact of perspective-taking on comprehension could depend on the quality of the narrative. Specifically, encouraging readers to empathise with the protagonist had a positive impact on adults'

comprehension of *Dubliners* (emotionally dense, naturalistic literature) but a negative impact on their comprehension of simpler, experimental narrative passages. Although children who reported adopting a character's perspective in Chapter 3 recalled the narrative passages from Chapter 2 more coherently, encouraging children to adopt a character's perspective by empathising or sympathising with the character (Chapter 5) was not found to improve children's comprehension. Perhaps, mental imagery training would improve children's ability to benefit from a perspective-taking prompts (de Koning et al., 2016).

Future directions

Based on the results from the current thesis, a logical direction for future research would be to explore the benefits of the various strategies on poor comprehenders' comprehension performance. This is because the strategies were specifically aimed at improving discourse-level Comprehension skills and poor comprehenders, as defined by Oakhill (1996), are at least average readers, but below-average comprehenders. Thus, this population could benefit a lot from Storyboard Construction (Chapters 2 and 4) and sympathising with the protagonist (Chapter 5). Children with Autism Spectrum Disorder (ASD), who have particular difficulty comprehending the mind-set of others, may also benefit from a couple of strategies explored in the current thesis. Especially the strategies that encourage readers to become more emotionally involved in characters' situations (e.g., Active Experiencing (Chapter 4) and sympathising with the protagonist (Chapter 5)). In addition, based on the unpredicted benefits of various strategies (e.g., sympathising with the protagonist on adults' comprehension of non-character information) as well as the collection null-findings, future research needs to continue exploring the effects of the various strategies on comprehension. In order to accomplish this goal, the approach needs to be multi-

faceted in order to determine (1) what particular elements of each strategy are most beneficial, (2) what specific elements of story comprehension the strategies are improving and (3) finally, to what extent the strategies could be blended or combined.

1. In order to achieve the first point, it would be helpful to video-tape readers using the strategies in order to assess to what extent they performed the strategy, as instructed, and, even more compellingly, to model what aspects (e.g., for AE, which gesture) of each strategy are linked to improved comprehension performance. For example, Cutica and colleagues (2014), in a similar intervention study, coded gestures children used, while learning information from an expository text, into four categories: representational gestures, deictic gestures, beats or motor gestures, or symbolic gestures. They also coded children's recollections of each idea unit into either a literal recollection, a proper recollection (the idea unit, but in the child's own word), or a wrong recollection. Thus, they were able to carry out an exploratory, frequency analysis to determine, for how many of a certain type of gestures children produced, how many of a certain type of recollections they produced. Potentially, a more advanced statistical analysis (e.g., a regression) could determine whether success at using a strategy (e.g., for Storyboard Construction) or using a certain type of movement or gesture (e.g., for Active Experiencing) predicted successful or unsuccessful recall and/or inferential comprehension. Alternatively, it would also be interesting to explore whether *full* Active Experiencing, as originally used in Noice and Noice (2001), adopted for use while reading a narrative (as opposed to a script), would be more beneficial than the version of AE used in Chapter 4.

2. In a similar vein, for future iterations of similar intervention studies, the narratives children read could be coded for specific *types* of idea units, to address the second point: to determine specific elements of story-comprehension the strategies are improving. For example, Berenhaus and colleagues (2015) coded narrative texts for three different types of idea units: dialogic idea units (i.e., what characters are saying), action idea units (i.e., what actions characters are performing) and descriptive idea units (i.e., descriptions of setting information) (Omanson et al., 1978). Then the study was able to determine whether the strategies children used (Active Experiencing or Physical Manipulation), while reading, were able to improve their memory for specific types of idea units (compared to controls). Future research could also explore to what extent certain strategies improve readers' *comprehension* of specific elements in narrative texts. This could be achieved by also coding potential correct and incorrect inferences children could make when answering inferential comprehension questions or freely recalling the narrative.

3. The most interesting prospect for future research is to explore the extent to which the strategies investigated in this thesis can be combined and/or blended. For example, aspects of AE could be applied to SB, and even more interestingly, we could compare the effects of asking children to construct a storyboard as if they are the protagonist versus an observer.

Overall conclusions

The current thesis demonstrated the benefits and limitations of storyboard construction and active experiencing on children's comprehension of narrative texts. In addition, the thesis provided a qualitative account of children's experience of mental imagery and perspective-taking, whilst reading normally. Finally, the thesis explored

the potential benefits of perspective-taking prompts on children and young adult's reading comprehension. This thesis presents one of the first attempts at unravelling the relationship between the comprehension process and readers' experiences of a narrative situation. What became the clearest from this experience was the realisation that every reader's experience with a story is unique and difficult to quantify. One of the most interesting findings was the identification of three different forms of perspective-taking (visualising, simulating and feeling), which are used by children while reading fiction. Although which mode a child chooses may or may not affect their comprehension, children who adopt a character's perspective do indeed remember narrative texts they read better than those who do not. Another significant conclusion from this thesis is the realisation that, whilst successfully constructing the visuospatial dimension of a mental model is crucial for narrative comprehension, also taking into account the impact of other factors, such as emotional expression and perspective-taking, is necessary for more accurately understanding readers' natural comprehension process .

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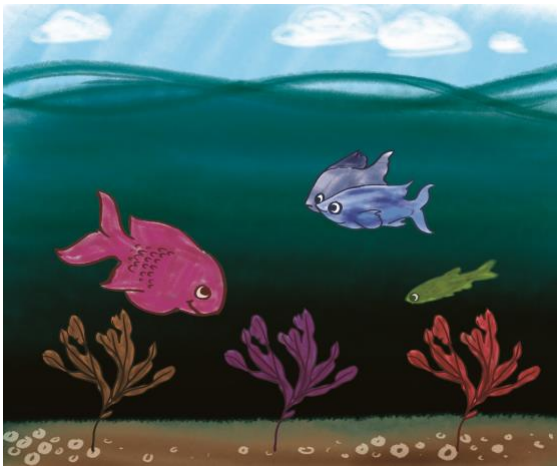
Appendices

I. Chapter 2: Idea unit divisions (the internal inconsistencies are in bold)

Al's Room	*Different Fish*
Al had been so busy playing	Many different kinds of fish live in the ocean.
with all of his toys	Some are large
that he hadn't noticed what a mess	and some are small,
he had made (the mess)	they come in a variety of colors.
in his bedroom.	Some fish are blue,
He knew he'd be in trouble	some are green
if he didn't clean up.	and some are pink.
His toys were everywhere.	Fish live in different parts of the ocean.
His blue, wooden cart	The pink and green fish
was lying upside down	live near the surface of the water,
on his bed.	but the blue fish
The toy cat and mouse	live way at the bottom of the ocean.
that used to live in the cart	**Different types of plants grown on the ocean floor.**
were now lying at the foot of the bed.	They are red,
The green rubber ball	purple
that had been sitting on the chair	and brown in color.
had rolled off	Fish only eat the read plants.
and was now underneath the chair.	**Fish know their food by its color.**
Al's yellow plastic plane	They do not eat any other color of plants,
had crash-landed	(they) only (eat) the red.
on the bedside table,	**There is absolutely no light at the bottom of the ocean.**
by the lamp.	It is pitch black down there.
that Al had been reading [= Al had been reading a book]	**When it is that dark, the fish cannot see anything,**
The open picture book	**they cannot even see colors.**
had fallen	
beside the ball.	
Al suddenly realized that it was almost dinnertime.	
Since his room was not messy,	
he went downstairs to eat.	

II. Included in Chapters 2 and 4: Storyboards with cut-outs

Bedroom Scene *Ocean/Fish tank Scene*



III. Included in Chapters 2 and 3: Protocol for scoring recall

The primary rater scored children's recall by comparing recall transcripts to a list of idea units from the story. Children received one point for every idea unit they recalled correctly. Correct idea units did not need to be recalled verbatim or in the correct order but they did need to be true to the story. For example, when recalling *Different Fish*, participant E024 said "it was pitch black at the bottom of the ocean so the fish found it *hard* to see." E024 was marked as correctly recalling "It is pitch black down there" but not "When it is that dark, the fish cannot see," because, although similar, finding it hard to see is not that same as not being able to see.

For *Al's Room,* children received one point for every correct object mentioned in his room, even if the object was not described in detail. For example, "bouncy ball" counted as the idea unit, "the green rubber ball" (Participant E008). This method was used because *Al's Room* included a variety of objects with specific descriptions whilst *Different Fish* only included different coloured fish and plants.

The second rater independently scored 10% of the recall transcripts from Session 1 and 2. Any differences were discussed.

IV. Included in Chapters 2 and 3: Protocol for scoring coherence of recall

Two raters independently scored children's coherence of recall by rating recall transcripts on a five-point scale. One point was given to children who recalled very little information. Two points were given to children who recalled half or so of the story but only listed the events. Three points were given to children who recalled the same amount of information as those who received two points but also attempted to connect events together (i.e., this happened and then this happened). Four points were given to children who recalled the majority of the story and connected up most of the story events. Five points were given to children who recalled most of the text and whose transcript read like a coherent story. The two raters compared their ratings and discussed any discrepancies.

V. Included in Chapter 2: Examples of very coherent (5 points) and non-coherent (1 point) story recalls

Al's Room – 5 points

E002: So at the beginning of the story, Al was, he was just playing with his toys that he didn't realise his room was really messy and his toy blue cart was lying upside down on his bed. The toy cat and the toy mouse were, that used to live in the cart, were beside the bed. The blue ball was, the blue rubber ball, that was on the chair, drove off, went under the chair. And then there was a toy plane that had crash-landed on the bedside table and um and Al went downstairs. And he knew that he would have to tidy it up otherwise he'd get told off and then he went downstairs to have breakfast.

Al's Room – 1 point

E039: he put some toys on the floor there was a cat and a mouse. His toy truck. His um I can't remember the last one. It was um…a I think it was a book I'm not sure. Yea I think it was a book.

Different Fish – 5 points

E008: um well there are different types of fish and red I think it was red and green live at the top near the surface of the water and blue ones live at the bottom near the bottom and there are different types of coloured plants down there and fish only eat the red ones it said and they can tell their food by the colour but sometimes they can't always see the colour and if they can't always see the colour they won't be able to know where it is because it's pitch black down there and they can't really see.

Different Fish – 1 point

E032: um the fish only eat the red

VI. Chapter 4: Example test story and comprehension questions (labeled according to question content and question type)

Playtime

While sitting on her bed, Katy looks around and wonders what would be fun to do with Jason when he comes over to play this afternoon. She's worried she won't be able to decide because she has so many toys.

Katy grabs her favourite comic book from the bedside table and flips through the pages. She loves reading. Maybe Jason will want to read her new comic book with her, thinks Katy. Or maybe Jason will want to play catch, thinks Katy as she looks over at her tennis ball, which was next to her comic book.

Daydreaming, Katy remembers the last time Jason came over to play. They ended up playing with her two stuffed animals, Mr. Cat and Miss Mouse the entire time. Katy looks over at Mr. Cat and Miss Mouse, who are on her pillow. She would rather not do the same thing again.

Katy hops off her bed and grabs her yellow, plastic plane, which landed on the wooden chair. Instead of playing with Mr. Cat and Miss Mouse, maybe Jason will want to pretend flying her plane around the house, thinks Katy.

Katy pretends to fly the plastic plane around her room until it lands on her bed. Katy thinks it might also be fun to take pictures of her adventures with Jason. She grabs her camera from where the plane just landed and checks to make sure the batteries are working. Katy is now really looking forward to Jason coming over.

Questions:

1. **Emotion Literal:** At the beginning of the story, how does Katy feel about choosing what to do when Jason comes over to play?
2. **Emotion Inference**: How do you think Katy would feel about reading comic books all afternoon with Jason?
3. **Spatial Inference:** Where in Katy's room is her tennis ball?
4. **Spatial Literal:** Where in Katy's room are Mr. Cat and Miss Mouse?
5. **Emotion Inference:** How do you think Katy would feel about playing with Mr. Cat and Miss Mouse all afternoon?
6. **Spatial Literal:** Where does Katy grab her plane from?
7. **Spatial Inference:** Where was Katy's camera before she picked it up?
8. **Emotion Literal:** By the end of the story, how does Katy feel about Jason coming over?

VII. Chapter 5 (Experiments 2 and 3): Example test story and comprehension questions (labeled according to question content and question type)

Kathy's Story

A week ago, just after Christmas, Kathy and her family moved house. Kathy was really happy at her old school and had lots of friends. She especially missed her best friend, Susan.

Today was Kathy's first day at her new school. She didn't want to go. She even thought about pretending to be ill so she could stay home and play video games but her video games and books were still in boxes in the garage. When she got in the car with her dad, she started to feel nervous. What if no one likes me? What if I don't make any friends?

Kathy arrived at school and found her classroom, which was right next to the music room. After the teacher, Ms Bunch, took the register, she asked Kathy to come to the front of the class and introduce herself. After taking a couple of deep breaths, Kathy told the class about herself. She moved here from Bristol and loved being in plays, especially musicals. Her favourite subjects at school were music and English. Kathy surprised herself with how calm she felt speaking in front of the class. When Kathy sat down, Ms Bunch started the maths lesson.

At lunchtime, Kathy decided to be bold. She sat at a table with a group of girls from her class. She had a great time. When the girls told her how impressed they were with how she spoke in front of the class, Kathy's cheeks went red. They spent the rest of the time chatting about their favourite musicals.

When Kathy got back to class, her stomach started grumbling. With all the excitement, her sandwich and crisps were left untouched in her backpack.

Questions:

1. **Non-character Inference:** In what season does the story take place?

2. **Emotional Character Inference:** How do you think Kathy felt about moving house?

3. **Non-emotional Character Literal:** What did Kathy want to do instead of going to school?

4. **Non-character Literal:** Had Kathy's family finished unpacking?

5. **Non-emotional Character Inference:** How did Kathy get to school?

6. **Emotional Character Literal:** How did Kathy feel on her way to school?

7. **Non-character Literal:** What was next to Kathy's classroom?

8. **Non-emotional Character Literal:** What are Kathy's favourite subjects at school?

9. **Emotional Character Literal:** How did Kathy feel while speaking in front of the class?

10. **Non-character Literal:** What happened after Kathy introduced herself?

11. **Emotional Character Inference:** How did Kathy feel about the girls' compliment?

12. **Non-emotional Character Inference:** What did Kathy forget to do?